National Park Service
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Natural Resource Stewardship and Science

South Florida/Caribbean Network Early Detection Protocol for Invasive Exotic Plants

Corridors of Invasiveness

Natural Resource Report NPS/SFCN/NRR—2013/675

ON THE COVER
Upper left: SFCN Botanist Robert B. Shamblin surveying the Rowdy Bend trail in Everglades National Park. Upper right: Using the "Mule" to survey Spite Highway on Elliott Key in Biscayne National Park. Lower left: Road survey near Chekika in Everglades National Park. Lower right: Airboat survey in Shark Slough within Everglades National Park.

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Change History

Protocol versions are tracked in the revision history log attached to the narrative and to each Standard Operating Procedure (SOP). Major changes results in an update by whole numbers (i.e., version 1.0, version 2.0, etc.) and minor changes by hundredths (e.g., version 1.01, version 1.02, etc.).

Version #	Date	Revised by	Changes	Justification

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Executive Summary

Exotic plant populations can be potentially catastrophic to the natural communities of South Florida. Aggressive exotics such as Brazillian Pepper (*Schinus terebinthifolius*) and Melaleuca (*Melaleuca quinquinervia*) have displaced native habitats and formed monocultures of exotic stands (Dalrymple et al. 2003). Nearby plant nurseries, especially the ones outside the boundaries of Biscayne National Park (BISC) and Everglades National Park (EVER), are a continuous source of new exotic species that may become established within South Florida's national parks. Early detection and rapid response to these new species of exotic plants is important to maintaining the integrity of the parks' natural habitats and is a cost-effective approach to management. The South Florida/Caribbean Network (SFCN) developed the *South Florida/ Caribbean Network Early Detection Protocol of Invasive Exotic Plants* to target early detection of these potential invaders.

Three national parks of South Florida will be monitored for invasive, exotic plants using this protocol: Big Cypress National Preserve (BICY), Biscayne National Park (BISC), and Everglades National Park (EVER). South Florida's national parks include some 2,411,000 acres of wilderness and encompass a variety of habitat types. To monitor the entire area for new species would not be feasible; therefore the basic approach of this protocol is to scan major "corridors of invasiveness", e.g., paved and unpaved roads, trails, trail heads, off road vehicle (ORV) trails, boat ramps, canals, and campgrounds, for new exotic plant species within the national parks of South Florida. Sampling is optimized using a two person crew: a trained botanist from the South Florida\ Caribbean Network (SFCN) and a certified pesticide applicator from the Florida and Caribbean Exotic Plant Management Team (EPMT). If infestations are small, they are treated immediately by the EPMT crew member. If large, they are quickly reported to park staff and the Exotic Plant Management Team specialist.

The sampling domain is partitioned into five regions, with one region sampled per year. Regions include the terrestrial habitats of Biscayne National Park, the eastern region of Everglades National Park, the western region of Everglades National Park, the northern region of Big Cypress National Preserve (BICY), and the southern region of Big Cypress National Preserve. Sampling usually is timed to capture flowering periods of different plant types (such as grasses that flower mostly in the fall months). Monitoring of roads, trails, and canals occurs while traveling into and through the parks (i.e., travel at 5-10 mph) using motorized vehicles, all-terrain vehicles, airboats, and/or hiking. Campgrounds, boat launches, trailheads, and similar areas, involve complete searches. When a plant of interest is observed, a GPS location is obtained and a voucher specimen collected if the plant is a new species. Information recorded at each location includes the species name, size of infestation, any treatment/control action taken, and any relevant notes. During the surveys, a GPS "track" is also recorded documenting the areas surveyed and the field of view is estimated. Field notes, pictures, and GPS data are compiled, entered, and analyzed in a Microsoft Access© database. Field reports are then produced and sent to contacts within the corresponding national parks.

The specifics of the methods used to accomplish the monitoring objectives are detailed in seven Standard Operating Procedures (SOP's): A) Preparation for Field, B) Survey Methods, C) When Exotics are Encountered, D) Data Entry, E) Uploading and Downloading GPS, F) Analysis, and G) Reporting. This document also includes several appendices including a list of site names and

places, the field data sheet, the field safety sign out sheet, a summary report product example, and database table descriptions. EPMT chemical treatment procedures are documented by the EPMT program separately.

Acknowledgments

We wish to acknowledge Tony Pernas of the South Florida and Caribbean Exotic Plant Management Team; Jim Burch, Botanist of Big Cypress National Preserve; Elsa Alvear, Resource Chief of Biscayne National Park; Jimi Sadle, Botanist of Everglades National Park; and Hillary Cooley, Botanist of Everglades National Park, for their assistance in reviewing and commenting on the trip reports and /or the protocol. This protocol was greatly assisted in formatting and content by the SFCN Quantitative Ecologist Andrea Atkinson, Data Manager Brian Witcher, and GIS Specialist Judd Patterson. In addition, this project was greatly assisted by the field efforts of Rick Jacobson, Penny Sawyer, Jonathan Moser, and Jose Luciani.

Background and Objectives

The National Park Service (NPS) South Florida\Caribbean Network (SFCN) and the South Florida and Caribbean Exotic Plant Management Team (EPMT) are collaborating closely on the development and implementation of this monitoring protocol to detect newly emerging and existing invasive plant species.

The South Florida\Caribbean Network is part of the National Park Service's Inventory and Monitoring program. The program's role is to inventory and monitor natural resources on National Park Service managed lands. National Park Service lands across the nation were divided into 32 networks based on physiographic similarity and administrative feasibility. The South Florida\Caribbean Network consists of seven parks including: Big Cypress National Preserve (BICY), Biscayne National Park (BISC), Buck Island Reef National Monument (BUIS), Dry Tortugas National Park (DRTO), Everglades National Park (EVER), Salt River Bay National Historical Park and Ecological Preserve (SARI), and Virgin Islands National Park (VIIS) (Figure 1). The information and understanding gathered from this science-based inventory and monitoring program is intended to improve resource management in national parks as well as inform public policy development to better protect the natural resources of this nation.

SFCN is co-located with the NPS Florida and Caribbean Exotic Plant Management Team (EPMT). The EPMT program was created in 2000 and is charged with assisting parks in preventing introductions of new species, reducing existing infestations, and restoring native plant communities and ecosystem functions. The Florida and Caribbean EPMT covers the same parks as SFCN plus some additional parks in north Florida.

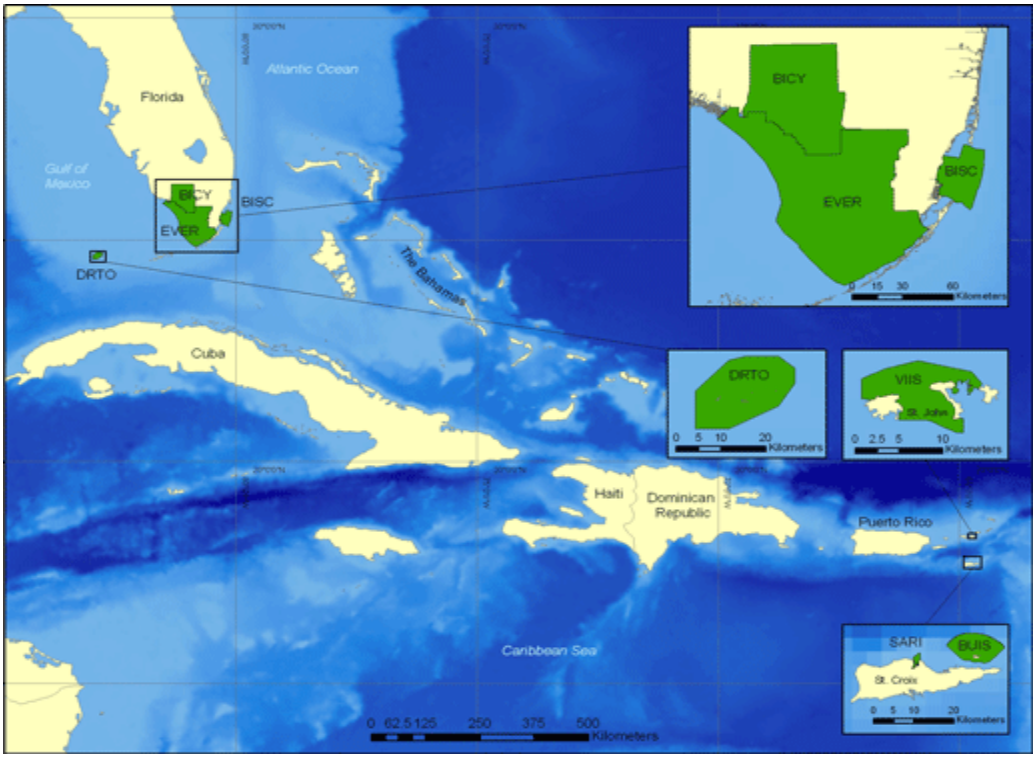

Figure 1. The seven national parks comprising the South Florida\Caribbean Network.

Invasive/exotic plants are one of the most serious threats to maintaining ecosystem integrity in the national parks of South Florida and were ranked 5th in priority out of 44 SFCN "vital signs" (indicators of park natural resource health) by over 100 area scientists, government staff, and non-government organizations. The process involved scoping of management issues, development of conceptual models, indicator identification workshops, online web ranking, and final review and approval by SFCN's Board of Directors and Science and Technical Committee (Patterson et al. 2008). Invasive exotic plant species can affect park natural resources and visitor satisfaction by altering the natural landscape, reducing habitat for native plants and animals, and increasing demand on park resources for trail maintenance and exotic plant eradication efforts. Early detection of invasive-exotic plants is a vital part of managing their presence in the SFCN national parks and preventing their establishment, thereby preserving the parks' native flora and fauna.

Vulnerability of SFCN parks to invasive species

The national parks of the South Florida area, i.e., Everglades National Park, Biscayne National Park, and Big Cypress National Preserve (Figure 2), are floristically unique from the rest of the United States. These parks contain a flora consisting of both wetland and upland species which can be either temperate or tropical in origin, often found growing in close proximity to each other. The "peninsula effect", suggested in Simpson (1964), denotes a decrease in species diversity along the peninsula from base to tip, and may have an effect on South Florida ecosystems where temperate species are reaching their southern limit and tropical species are reaching their northern limit, allowing for niches that can be filled by exotic species. This vulnerability is coupled with proximity to a large metropolitan area which draws visitors from around the world to the parks plus a large landscaping nursery industry which can be a source of new exotics.

Other parks within the SFCN are predominantly small island parks, i.e., Dry Tortugas National Park and Buck Island Reef National Monument, and large island parks, i.e., Salt River Bay National Historical Park and Ecological Reserve and Virgin Islands National Park. These island parks are particularly susceptible to introduction of new invasive species.

Invasive species in South Florida and the Virgin Islands not only involve grasses and herbs, but also include shrubs (e.g., *Schinus terebinthifolius*) and trees (e.g.,*Melaleuca quinquenervia*) which can radically alter vegetation structure and habitats for native flora and fauna. The Florida Exotic Pest Plant Council 2011 Invasive Plant Species List included 77 Category 1 invasive species and another 76 Category 2 species (http://www.fleppc.org/list/11list.html, accessed 7/26/2012).

Existing programs

Two methods are currently underway (both conducted by the Florida and Caribbean Exotic Plant Management Team) for assessing the extent and distribution of invasive plant species in south Florida and U.S. Virgin Island parks: 1) Digital Aerial Sketch Mapping (DASM) and 2) complete surveys.

DASM was developed in the 1990's by the USDA Forest Service for the aerial detection and mapping of forest pests and pathogens. In 2005, the National Park Service (NPS) and the South Florida Water Management District (SFWMD) conducted an accurate and cost effective pilot

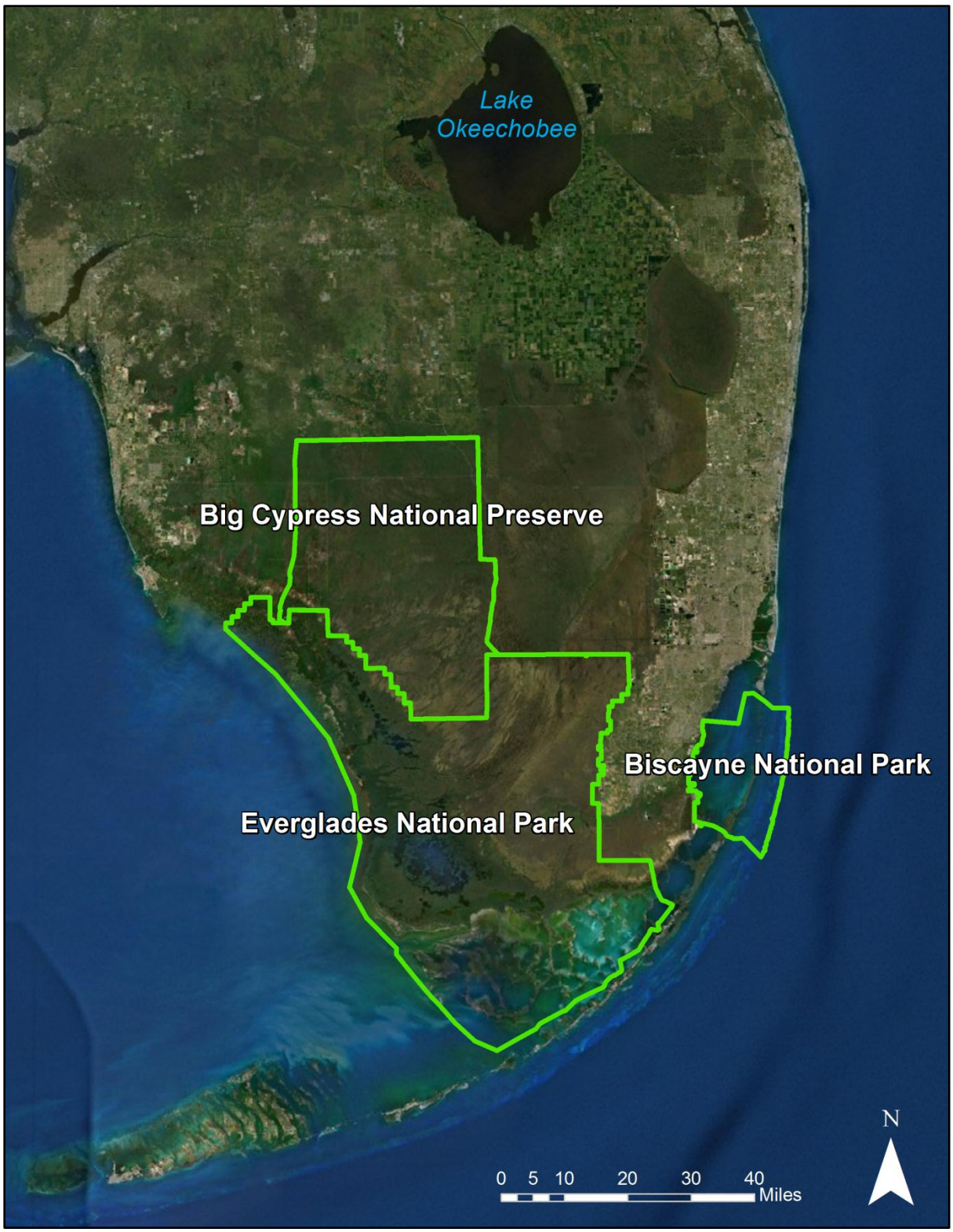

Figure 2. Exotic plant surveys are conducted in the three National Parks of south Florida: Big Cypress National Preserve, Everglades National Park, and Biscayne National Park.

project utilizing DASM technology for the mapping of invasive plant species in the 4 million-acre Everglades Protection Area (Figure 3). Using an aircraft, observers sketch invasive plant distribution on touch-sensitive computer displays showing the aircraft's GPS position against a background of moving digital aerial photos and background data. This method is operational for the Everglades Cooperative Invasive Species Management Area in Big Cypress National Preserve (BICY) and Everglades National Park (EVER) every 2 years.

For the islands in Biscayne National Park (BISC), Buck Island Reef National Monument (BUIS), and Dry Tortugas National Park (DRTO), when an invasive species control effort is conducted, the EPMT specialist and contractors do a complete survey of the islands involved, noting all invasive species.

While these existing programs are good at detecting large populations of known invasive exotic species (e.g., visible from a helicopter and/or identifiable by a contractor with a specific list of known invasive plants), in the larger parks these programs are less likely to detect newly established exotic plants with the potential to become invasive but which are previously unknown in the park. Detecting new species with the potential to become invasive while they are still in small controllable populations is important because the probability of treatment success is high, and cost-effectiveness is maximized. However, detecting these newly emerging problem species requires personnel with an extensive knowledge of the native vegetation of a park such that they can rapidly spot the "odd" species against the background of myriad native species. In addition, as conducting complete searches of any but the smallest parks is not feasible; the sampling strategy for detecting these species differs from the existing efforts.

The most successful and cost effective strategy for preventing the establishment of exotic plant species is to implement an early detection plan for these species (Hobbs and Humphries 1995, Randall 1996, Rejmanek and Pitcairn 2002). The method of early detection through observation of pathways by which invasive-exotics become introduced into an ecosystem is suggested in *General Guidelines for the Establishment and Evaluation of Invasive Species Early Detection and Rapid Response Systems*, published by the National Invasive Species Council in 2003. This report proposes the use of active detection networks along high risk locations (corridors) to catch invasions early, before they develop into a larger problem, and respond adequately. A study of prevention and control of invasive zebra mussels in Michigan lakes found that investing in prevention methods over control methods was a more effective form of invasive management (Leung et al. 2002). Prevention measures are currently employed by the U.S. Coast Guard in an effort to halt the transport of marine invasive species in ships' ballast water from port to port. Ships with ballast water are required to follow a series of rules regarding discharge and reporting of discharge. Consequently this protocol focuses on monitoring areas suspected of being high risk for invasive-exotic plant introduction (termed "Corridors of Invasiveness") and quickly preventing their establishment and development into larger populations requiring more intensive management.

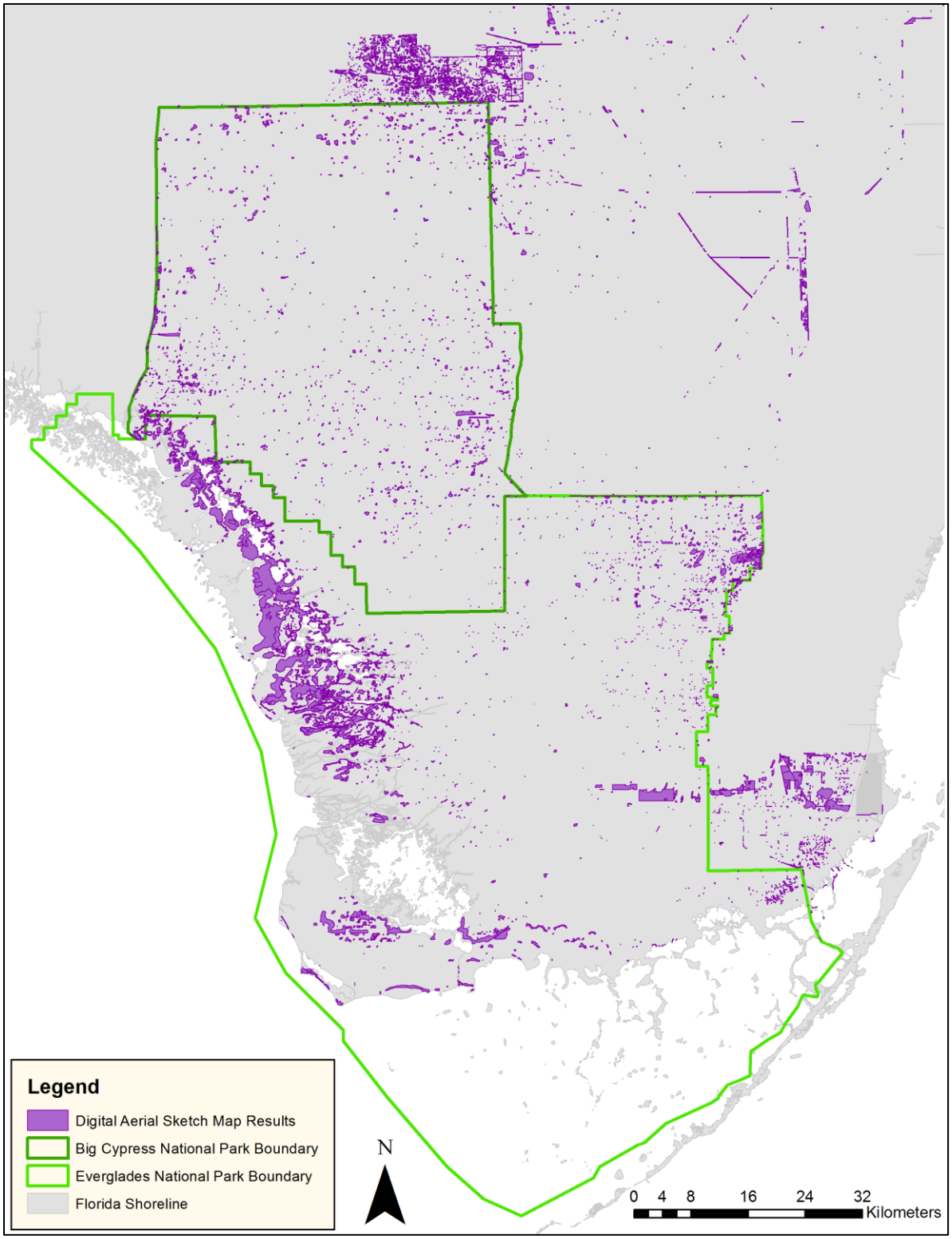

Figure 3. Digital Area Sketch Mapping (DASM) results from 2009-2010 for Big Cypress National Preserve and Everglades National Park. The polygons represent the areas where exotic plant species were observed. DASM is conducted by the NPS Exotic Plant Management Team every two years.

Identifying "Corridors"

"Corridors of Invasiveness" are defined in this protocol as areas that allow or facilitate the introduction of exotic species due to intentional or non-intentional human activities. The corridors of invasiveness function as in-roads or access into natural areas allowing for a seed source for colonization, and ultimately an introduction site for founder populations to start from. The general assumption is that plant species with human assisted dispersal mechanisms can potentially be introduced via a corridor into natural habitats. Seeds or propagules can be moved by attaching themselves to clothing or equipment and by humans actively transporting them from site to site (i.e. hiking trails, ORV roads). The seeds or propagules can readily invade areas where there is disturbance or in areas that are more open and receive a large amount of sunlight (i.e., trails or trail heads, road stops, campgrounds). For our purpose, the corridors of invasiveness is further restricted to plant species that are new to each of the specific parks.

Corridors of invasiveness are somewhat similar to but also different from the 'wildlife corridors' that are mentioned in other contexts. For wildlife, corridors assist connectivity between populations, increase effective population size and facilitate establishment or re-establishment of populations. A wildlife corridor, or green corridor, is an area of habitat connecting wildlife populations separated by human activities (such as roads, development, or logging) (Bond 2003). Wildlife corridors allow for an exchange of individuals between populations, lowering inbreeding within populations, so increasing effective population size, and facilitating re-establishment of populations that have been decimated or eliminated due to random events. Wildlife corridor's traits potentially moderate some of the detrimental effects of habitat fragmentation. Conversely, corridors of disturbed habitat (i.e. roads, trails, etc.) may also act as avenues for detrimental purposes in the case of exotic plants, which can use corridors for infiltration into undisturbed habitat.

Corridors of invasiveness include paved and unpaved roads, trails, trail heads, ORV trails, boat ramps, campgrounds, and canals.

Roads – Vehicles such as cars and trucks can transport seeds, which are then dispersed along roadways. These areas are often highly disturbed, allowing exotic plants the opportunity to become established. For some species, this disturbed area itself becomes a corridor, allowing for dispersal.

Trails – Humans transport seeds in hiking gear, on clothing, and on ATV's. These seeds can then be dispersed along the trails. Also, animals use these trails and may disperse seeds that are attached to them.

Canals – Boats transport seeds and propagules, which are often attached to boat motors, propellers, and trailers. These are then carried to new areas where the boats are taken, where the seeds and propagules fall off and may become established. The canals then act as avenues of faster water movement than the surrounding wetlands.

Campgrounds – Campgrounds are where people congregate and where exotic plant species can become established. Seeds or propagules may be brought into campground areas by attaching

themselves to tires, clothing, camping and hiking equipment, or from pets. Seeds from fruits and vegetables may also become established from refuse.

Boat Launches – Boat launches are where people congregate, throw garbage away, and bring in attached plant life on boats and vehicles. Seeds may also collect in bilge water or within motors, or attach to propellers and trailer tires. These seeds may fall off and become established populations.

Airboat Trails – Airboats can also carry seeds and propagules to new areas. Seeds may attach to the airboat, trailer, or people's hiking and camping gear.

Monitoring Objectives

The monitoring goal of the *South Florida \ Caribbean Network Early Detection Protocol of Invasive Exotic Plants*: *Corridors of Invasiveness* is to detect newly emerging invasive plant species and infestations in the national parks of South Florida in order to provide the EPMT and park management with effective decision making information. The specific monitoring objectives include:

1. Detect new species of exotic plants along corridors of invasiveness (i.e., roads, trails, canals, campgrounds, boat launches, and airboat trails).
2. Detect new invasions of existing exotic plants along corridors of invasiveness.
3. Determine status and trends in percent infested area and distribution of infestations along corridors of invasiveness.
4. Survey all selected corridors of the three target parks within a 5-year period.

Due to logistical and time restraints, only the three national parks of South Florida will be monitored for this project: Big Cypress National Preserve (BICY), Biscayne National Park (BISC), and Everglades National Park (EVER) (Figure 2).

Sampling Design

Sampling Approach and Rationale

The sampling approach identifies all official corridors of invasiveness, i.e., roads, trails, canals, campgrounds, boat launches, and airboat trails, where humans may introduce new species to the parks. Areas that are unfeasible to sample, are too dangerous (major highways) or, historically, do not cause species introduction problems (i.e., chickees, which are raised platforms in waterways for canoe or kayak camping) are excluded. One hundred percent of the rest of the official corridor survey areas are monitored over the course of a five year rotation. Monitoring the corridors focuses sampling effort on areas where plants are more likely to be introduced first (along the corridors).

Pilot Study Roadside Survey Estimate of Time and Distance

A pilot study was conducted to test the field methods in this protocol and produce realistic estimates of survey times and distance covered (Table 1). This pilot work was used to finalize the sampling frame and level of effort feasible for this protocol.

Table 1. Pilot study estimates of time required for surveys in different habitats.

Location	Distance	Time	Miles/hour	Comments
Chekika Road (EVER)	14 miles	2.7 hrs	5.4 mph	Wet prairie habitat. Made frequent stops to investigate suspicious plant species or areas of concern. This area is an open habitat with patches of trees and shrubs, sometimes dense stands, which may take longer to survey if there are extensive patches of dense vegetation.
Loop Road (BICY)	27.84 miles	8 hrs	3.48 mph	Took longer to cover the ground due to a denser, more forested type of habitat than that of the open prairie.
Canal Roads (BISC)	11.31 miles	4.5 hrs	2.51 mph	This area takes the most amount of time to cover due to dense vegetation and narrow roads contributing to hazardous driving conditions. These are canal roads allowing for the passage of only one vehicle, and are sometimes too narrow to turn the vehicle around. Extra precautions are needed, such as driving slowly and having a scout to watch for unseen drop offs. Progress is also slowed by having to survey the eastern extremities of the canal roads and trails by foot.
Average			3.5 mph	

Sampling Frame

All official, publicly accessible roads, trails, canals, campgrounds, boat ramps, and airboat trails, within the boundaries of Everglades National Park, Biscayne National Park, and Big Cypress National Preserve were identified as possible survey sites. At this time unofficial trails are not surveyed as their visitation is assumed to be lower and due to feasibility constraints.

Some survey areas were discarded or restricted for safety or for feasibility reasons. For instance, Interstate Highway 75, which runs through BICY, Tamiami Trail on the northern border of EVER, and the main EVER park road, were discarded for safety reasons as it was deemed too dangerous to drive at idle speed just off a main highway; instead the focus is on places where

people stop and get out of their cars to hike trails, go boating, or sight-see. Most chickee campsite platforms are not included in the survey. Chickee campsites are usually standing in open water with little or no ground cover for exotic plants to become established; however, chickee campsites located on or adjacent to land will be surveyed. Also, Off Road Vehicle (ORV) trail surveys in BICY are restricted to the trailheads and the first 100m inland from the trailhead, as near the trailhead was deemed the area of highest potential for introduction and due to feasibility concerns of surveying the many miles of these trails (Figure 4). Additional 100m segments are added if exotics are still being found along the trail towards the end of the first 100m. Airboat trails are similarly restricted to the first 1km from the boat launch. If exotics are found near the end of the first 1 km, then 500m segments are added until no exotics are found.

All these selected corridor survey areas, called "sites" below, were then grouped into regions, and different regions within a park are selected for surveying in a given year (Figure 5; see Appendix A for list of sites). In the future, it is possible for this list of corridor survey sites to be modified through time, e.g., new trails are opened, other trails are closed, and some roads surveyed are determined to be too dangerous.

Sampling Effort

A complete sample of all selected survey sites in the three parks occurs every five years. Sampling effort is balanced across years by using a rotating design, with year one starting in Biscayne National Park (Figure 6), year two dedicated to the eastern region of Everglades National Park (Figure 7), and year three dedicated to the south region of Big Cypress National Preserve (Figure 10). Because most of the area of Biscayne National Park is marine, survey sites are restricted to areas of the mainland and a few of the off-shore keys. Therefore, all of BISC can be surveyed within one annual cycle. Since all of BISC will be surveyed in a single year, year four will be dedicated to the western region of EVER (Figure 7), and year five will be dedicated to the north region of BICY (Figure 10), with year six starting the cycle over again, and dedicated to all of BISC (Table 2).

Table 2. Annual surveying schedule for invasive exotic plants.

Year	2011	2012	2013	2014	2015
Park to be surveyed	**BISC**	**EVER**	**BICY**	**EVER**	**BICY**
Number of sites to be surveyed during the year	all sites	eastern sites	southern sites	western sites	northern sites

A five year rotation is what is considered realistic given the number of corridor survey sites to be monitored and the limits of SFCN and EPMT staff time. However, nothing in this protocol should preclude park staff or other partners from undertaking additional monitoring to expand the frequency or scope if sufficient resources are available.

Timing of sampling

Preparation for field sampling begins in January of each calendar year (Table 3). The months of January, February, and March are spent reviewing results from the last monitoring event for the Park that is to be sampled that year. For example, if it is the second year of the surveying schedule (EVER eastern sites), then a review of the results from the last monitoring event for the eastern sites of EVER should be conducted for the researchers to familiarize themselves with locations of previous findings, locations of harder to find species, and areas that were previously

Table 3. Annual sampling timeline and personnel tasks.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sampling Timeline	Review previous sampling results for Park to be sampled			Prep for fieldwork	Field sampling from May through August				Process data and GIS files	Prepare annual summary report		
Personnel Tasks - SFCN Botanist	Review EDDmapS for latest listings of exotic plants for Park to be sampled; review findings from last sampling event for Park to be sampled			Prepare datasheets and maps, load GPS units with waypoints and tracklines from last sampling event for Park	Conduct surveys; make sure all sites are monitored; record data; take pictures as needed; collect unknown specimens				Compile and write up results for current year sampling, update EDDmapS, update fact sheets			
Personnel Tasks - EPMT Technician	Review EDDmapS for latest listings of exotic plants for Park to be sampled; review how much herbicide was used on last sampling event for Park to be sampled			Prepare herbicide and safety gear	Assist in conducting surveys and recording data; drive vehicle; apply herbicide to small infestations; take pictures as needed							
Personnel Tasks - Data Manage-ment Team				Assist with preparation if needed					Assist in data verification, producing figures and tables for summary report, review finished report, publishing report, update metadata & archive datasets, update EDDmapS, update fact sheets and web page			

treated to check effectiveness of treatment. Tracklines and waypoints from the previous sampling event are loaded onto the GPS unit to act as survey guides for the upcoming sampling event (Figures 8 and 9). Also during this time, check recent exotic plant listings to EDDMAPs for the Park to be monitored that year. The EPMT technician should review the amount of herbicide used during the last sampling event for the specific Park (or section of the Park) to gage the amount needed for the upcoming sampling event. During the month of April is when preparation for the field takes place. The SFCN botanist makes sure that all items are prepared for the field, including data sheets, cameras, items for specimen collection, GPS units loaded with the previous sampling's waypoints and tracklines, and that appropriate vehicles are available and ready to go. Also during April, the EPMT technician prepares all herbicide needed for fieldwork, and that all safety equipment for herbicide use are in working order.

Field work itself generally begins in the month of May and ends about the end of August or early September. Fieldwork usually takes three to four weeks (15-20 work days) to complete, but can be spread out over the course of a four month period to coincide with flowering times which make plant identification easier. Flowering broadleaf plants generally flower in the spring, while grasses generally flower in the fall months. In September, data collected in the field in entered into the database and checked for accuracy. The SFCN botanist makes sure that the data is properly entered, and the Data management Team assists in making sure the entered data is verified before initiation of report writing. In late September to early October, the annual summary report is written by the SFCN botanist with help from the Data Management Team. Upon completion of the annual summary report, the report is then distributed by the SFCN botanist to personnel at the Park where the surveys took place. The annual summary report is then added to the SFCN website by the Data Management Team. Writing the annual summary report, its distribution to the appropriate Park and posting the report on the website is done during the months of October to December (Table 3).

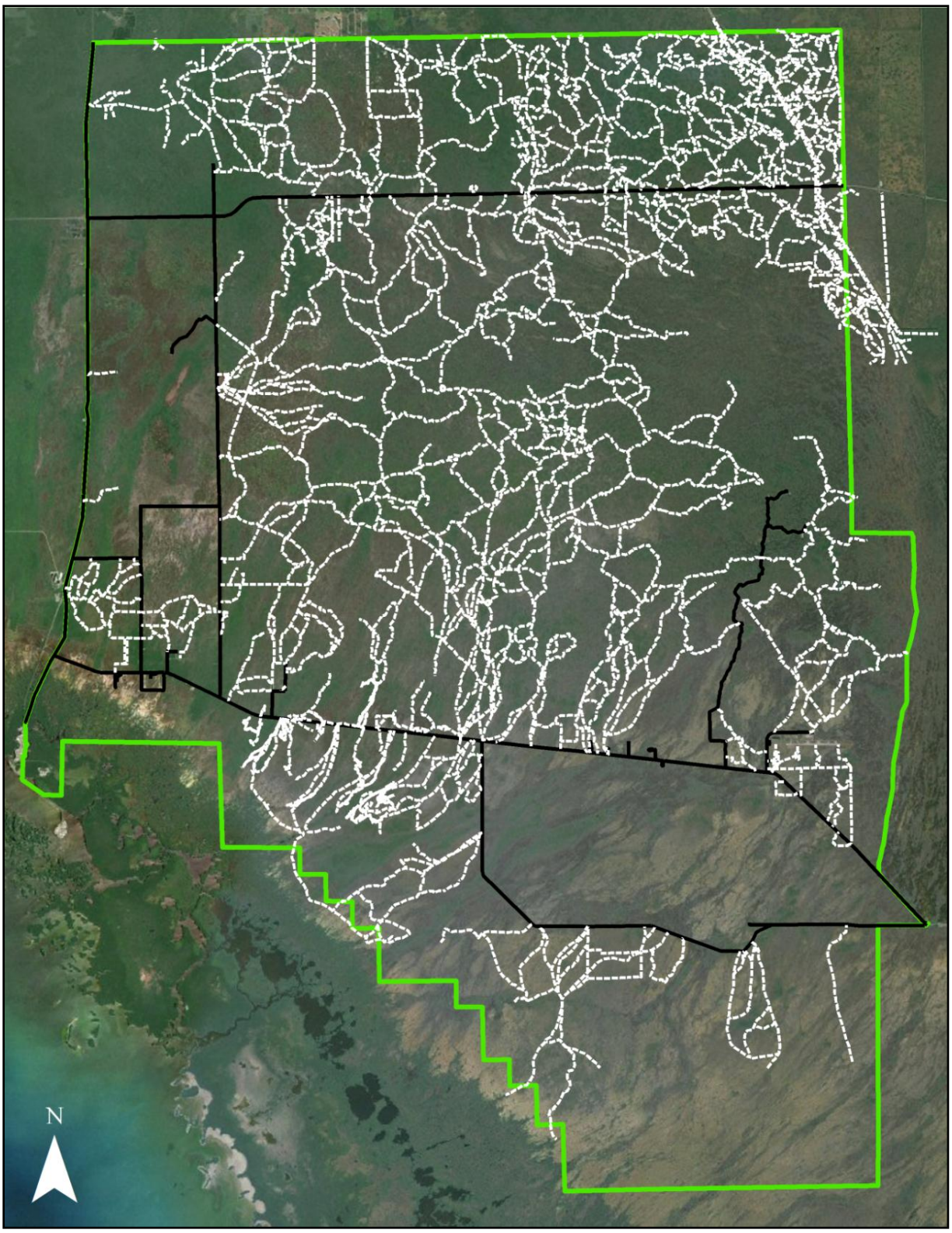

Figure 4. Accepted ORV trails within Big Cypress National Preserve (white lines). Off Road Vehicle (ORV) trail surveys in BICY are restricted to the trailheads and the first 100m inland from the trailhead, due to practicality concerns of surveying the many miles of these trails.

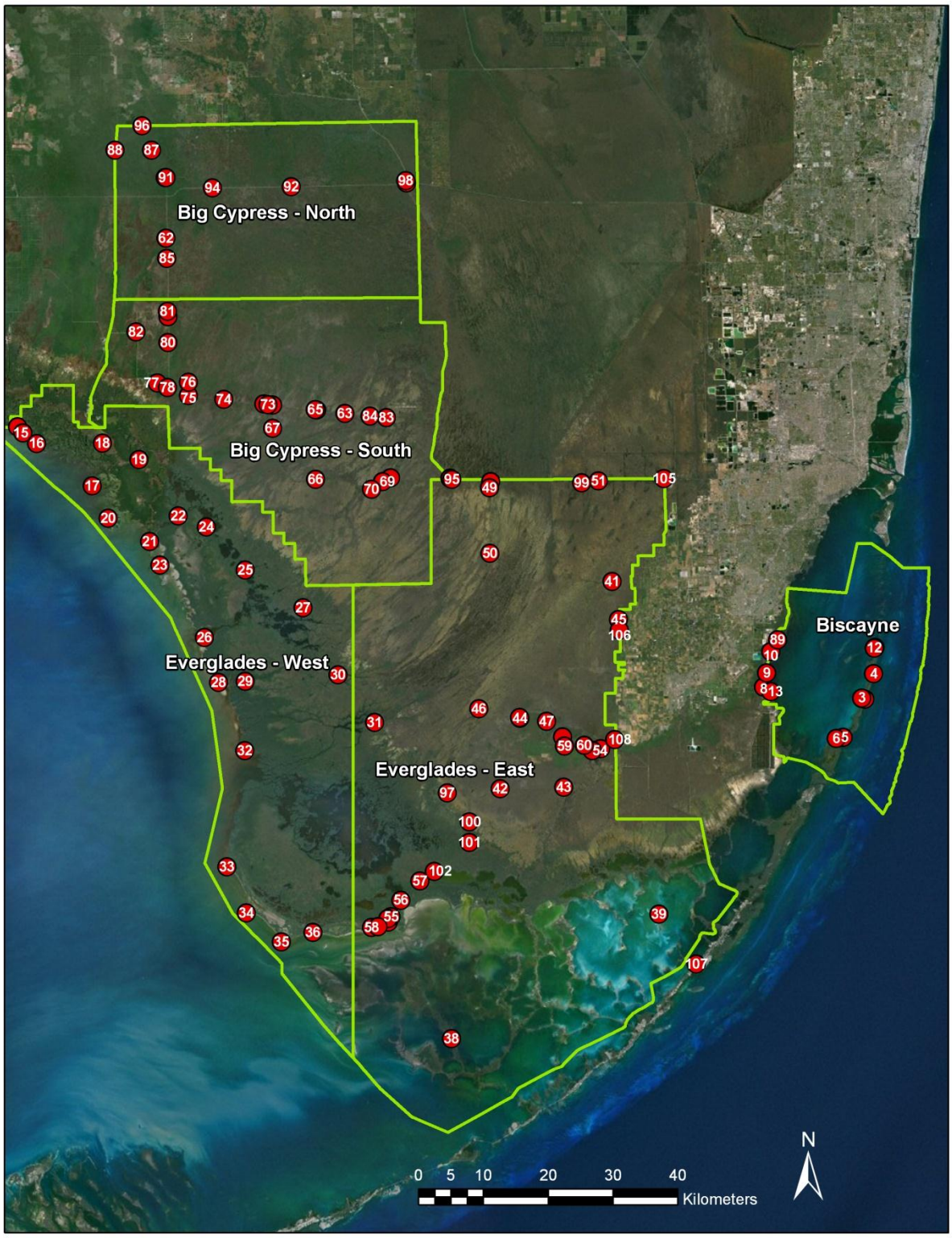

Figure 5. Selected corridor survey sites for Everglades National Park, Big Cypress National Preserve, and Biscayne National Park. Points show starting points for campgrounds, trailheads, and roads to be surveyed for the Corridors of Invasiveness Project.

Figure 6. BISC starting locations for exotic plant surveys. In the five year sampling rotation, BISC will be monitored during the first year. All corridor survey sites are monitored in year one.

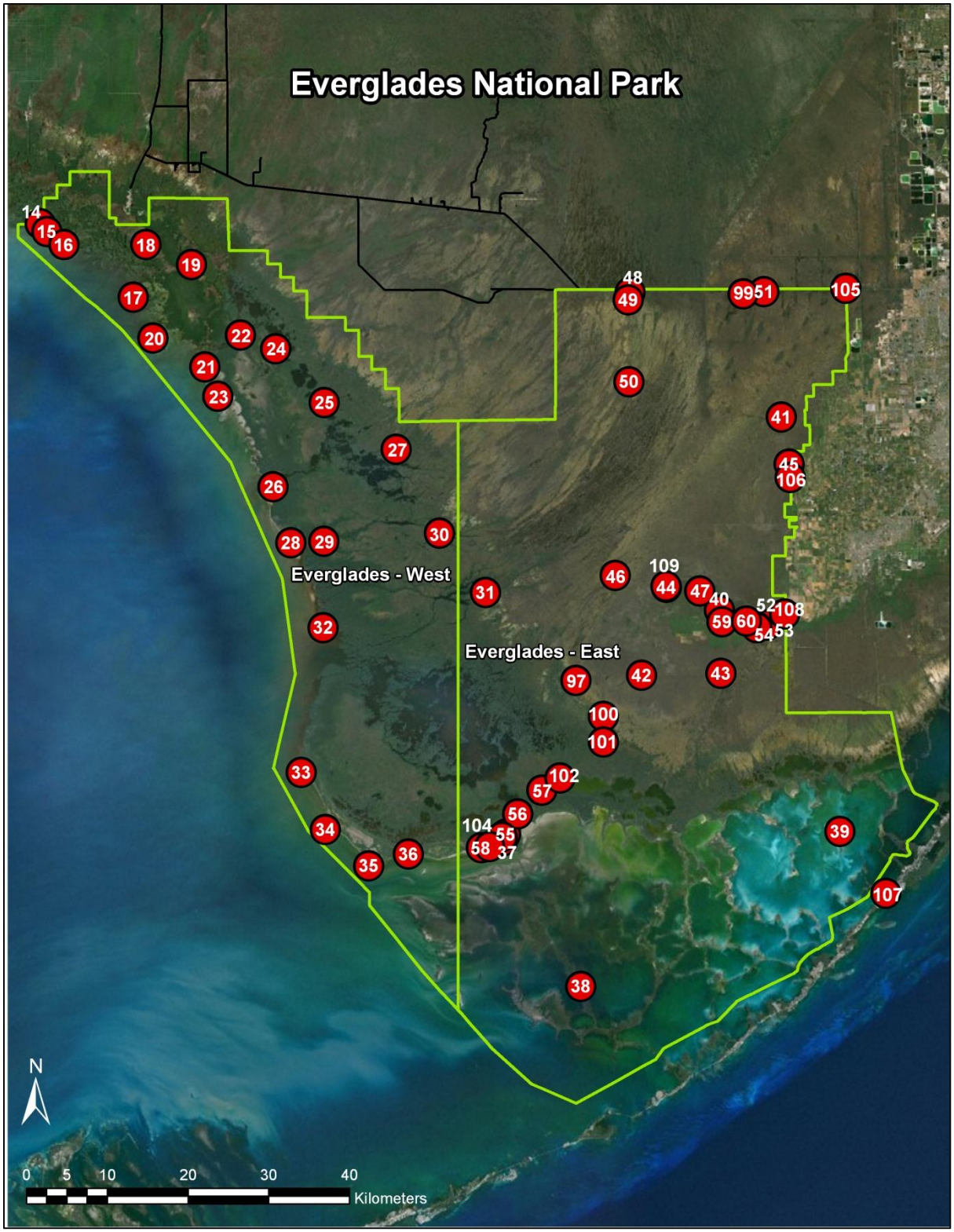

Figure 7. EVER starting locations for exotic plant surveys. In the five year sampling rotation, EVER – East will be monitored during the second year and EVER – West will be monitored in the fourth year. Points show starting points for the exotic plant surveys.

Figure 8. An example of a surveyed trail complete with tracklines and the starting waypoint located at the trailhead in EVER (in this case starting location 56 from Figure 7). Tracklines and waypoints from the previous sampling event are loaded on the GPS unit to act as sampling guides for the upcoming field surveys.

Figure 9. Site 56 zoomed in (from Figure 8). Notes can be added to show the trailhead, any gates associated with trails and areas where the vehicle may be parked.

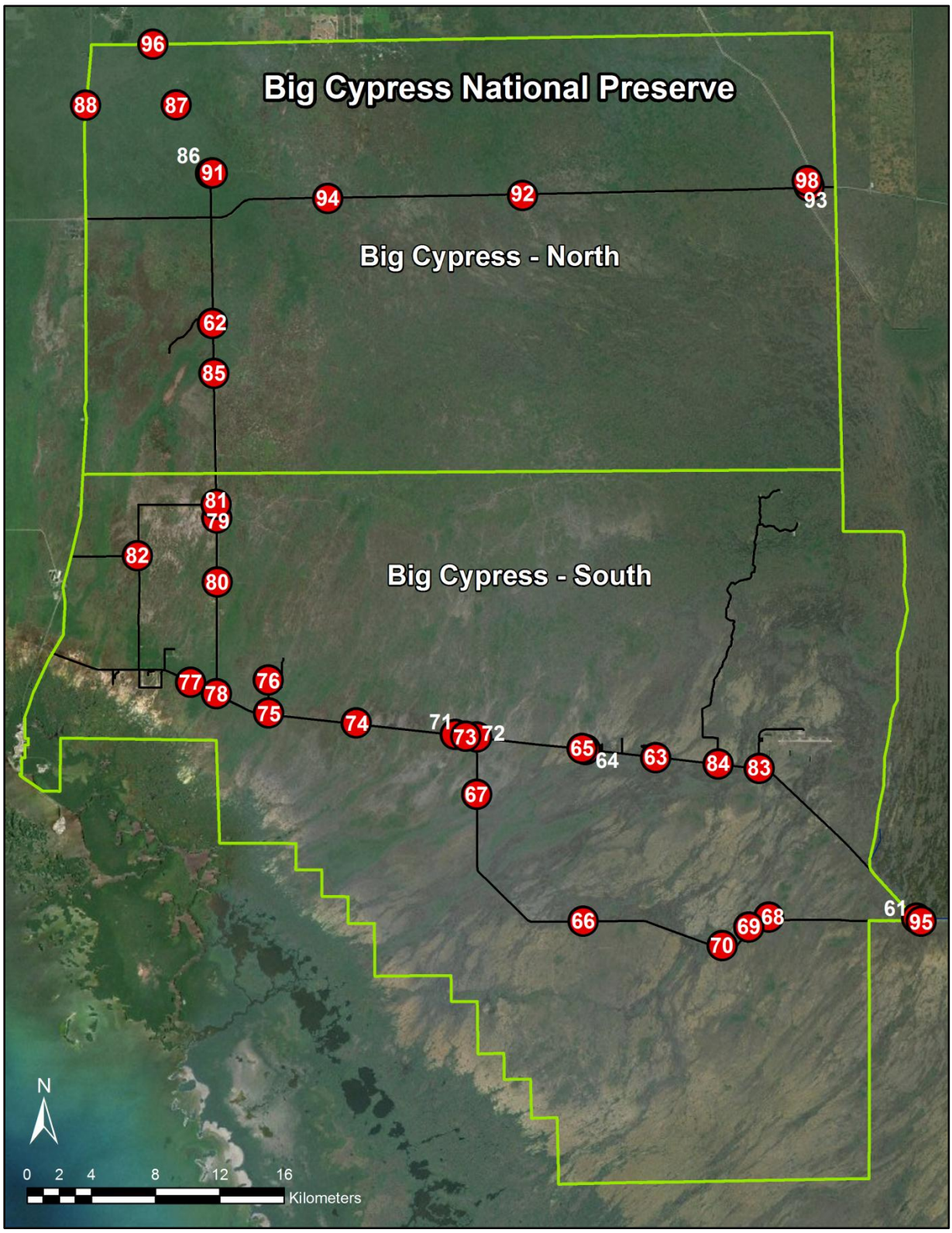

Figure 10. BICY starting locations for exotic plant surveys. In the five year sampling rotation, BICY – South will be monitored during the third year and BICY – North will be monitored in the fifth year.

Field Methods

Preparing for the Field

Preparations for fieldwork are found in "Standard Operating Procedure A – Preparation for Field" and include equipment lists, safety procedures, vehicle preparation, and uploading of GPS points for survey site start points.

Survey Methods

Survey methods are described below and detailed explanations for entering data on the field data sheet (Appendix B) are provided in "Standard Operating Procedure B – Survey Methods." The field survey consists of a crew of two: an SFCN field botanist and a field technician from the Exotic Plant Management Team (EPMT). The EPMT technician drives the vehicle for roadside surveys while the botanist monitors the roadside for new species of exotic plants. When an exotic plant is discovered the EPMT field technician is responsible for eradicating small populations immediately (see "Standard Operating Procedure C – When Exotics are Encountered"). If an EPMT field technician is not available, other staff may be used as an assistant, but no chemical control can occur. "Field of view" estimates are estimated at the beginning of each survey to describe the distance from trails or roads which are easily observable (Figure 11). In general the field of view estimate is the distance where the observer has high confidence they can identify exotics (or unknown plants) in all three vegetation structure layers, i.e., herb layer, shrub layer, and tree layer. When a major change occurs in the field of view estimate (e.g., a change from 10 to 20m), these points are marked with the GPS and the new field of view estimate recorded. If the observer spots an exotic outside this field of view (e.g., trees are visible at greater distances), it is still recorded but marked as outside this high confidence field of view.

Figure 11. Example of a corridor with field of view estimates. In open habitats, such as prairie, the field of view is good to approximately 20m. In more densely vegetated shrub or forest habitats field of view is restricted to just within the edge of the wooded habitat. The size of the corridor (yellow rectangle) is defined by the field of view.

Road Surveying

Road surveys include roads originating from outside or at park boundaries and entering the park (Figure 12). Also, roads running along the park boundaries will be surveyed and at areas of high disturbance or high visitor use, such as stop-offs, picnic areas, and fishing ponds.

The road surveying method (Figure 12) is performed by a crew of two driving a research vehicle at idle speed (2-10 mph) along official park roads (both paved and unpaved) with the goal of detecting early invasions of exotic plant species currently not listed as existing within the park boundaries. The crew of two includes a driver and a trained botanist. The botanist views one side of the road on the initial sweep and the other side of the road on the return sweep. When new exotic plants are detected their location is marked on a handheld GPS unit (Garmin 60CSx), digital photos are taken of the new species, a specimen of the new species is collected for verification, and notes are recorded regarding species name, plant description, size of the infestation, number of individuals in the infestation, the plant community the infestation is taking place in, and location characteristics (see Appendix B for the field data sheet). If the species is unknown to the botanist, a specimen of the plant is collected for documentation and for species identification.

Road surveying is a useful method for covering a lot of area with minimal effort, however, road surveys are affected by limited field of view in certain habitats such as dense shrublands and forests (Figure 11). Single individuals of an exotic plant species, especially those of small stature (1m in height or smaller), may be missed by the roadside surveying method, however, colonies of the exotic species or larger individual specimens are generally sighted.

Figure 12. The roadside survey method consists of two researchers driving at idle speed along park roads with the goal of detecting early invasions of exotic plant species.

Field of View Estimates – Roadside Survey

Prairie Habitat – This habitat is a vast area of open grassland with a few shrubs. Visibility from the truck is generally good; however, there can be patches of thick vegetation along the roadside that greatly decrease the field of view. In these instances the field of view was restricted to the area immediately adjacent to the roadside, approximately 2-5m. In most areas the emergent vegetation (emergent vegetation is classified as trees and shrubs > 2m in height) obstructed view to approximately 10m. When the field of view was unobstructed, emergent vegetation was visible to approximately 20m. Vegetation 1m in height was visible to approximately 10-15m. Vegetation shorter than 1m in height (grasses and groundcover) is visible to approximately 5m (Figure 13). So on the data sheet the observer would typically record 5m or whatever the observer feels confident with readily observing all strata.

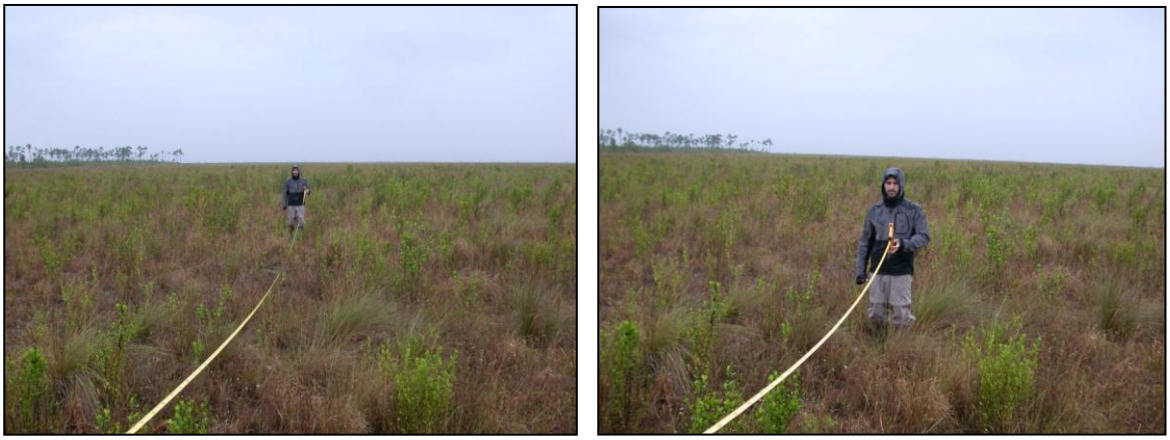

Figure 13. Field of view in open prairie habitat. Shrubs 1m in height or greater are clearly visible to 15m from road (left). Shrubs and grasses less than 1m in height are clearly visible to 5m (right). So on the data sheet the observer would typically record 5m or whatever the observer feels confident with readily observing all strata.

Forested habitat **–** These habitats are generally densely vegetated and, accordingly, field of view is more restricted than that of prairie. When the field of view is unobstructed from the roadside, emergent vegetation 2m or more in height are visible to 15m. Vegetation 1m in height, visibility is good to 10m (Figure 14 left). Vegetation less than 1m in height, visibility is restricted to about 2m due to obstruction from other shrubs and trees (Figure 14 right). In many cases, as in dense shrublands and forests, the field of view will be restricted to the dense vegetation at the edge of the road (Figure 14). So on the data sheet the observer would typically record 2m or whatever the observer feels confident with readily observing all strata. Exotic shrubs and trees outside this field of view are still recorded but specified as such in the comments.

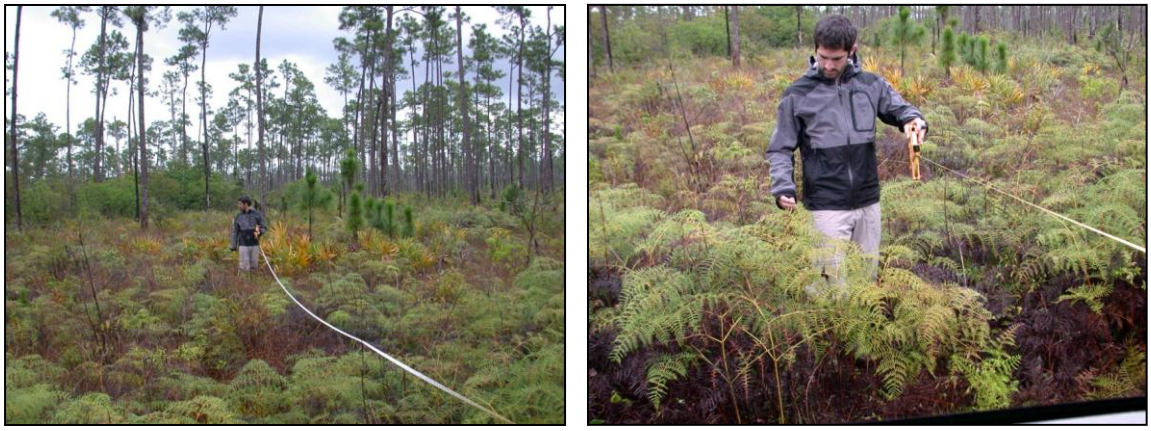

Figure 14. Field of view in forested habitat. Vegetation greater than 1m in height is clearly visible to 10m (left). Vegetation less than 1m in height are only visible to about 2 m from the road (right). So on the data sheet the observer would typically record 2m or whatever the observer feels confident with readily observing all strata. Exotic shrubs and trees outside this field of view are still recorded but specified as such in the comments.

Walking Surveys

Walking surveys are useful when vegetation is low statured (< 1m in height), when vegetation is dense (Huebner 2007), when areas are not accessible by vehicle, or when surveying hiking trails, trail heads, boat launches, or campgrounds. This method is performed by a team of two, which includes a trained botanist and an assistant to help with image gathering, collecting GPS locations, collecting plant voucher specimens, and treating exotic plants. The walking method is a slower and more thorough approach for areas not accessible by vehicle, or areas that require a more detailed investigation.

Hiking Trails – Hiking trails, including those originating from campgrounds, and off road vehicle (ORV) trails at trailheads and entering the park interior for 100m. Hiking trails usually start at visitor centers or at parking lots, so these areas at trailheads and the beginning 100m of the trail will be the focus of the survey. ORV trails also originate at trail/road parking areas and continue on into the interior of the park. Again, the first 100m of the ORV trail should be monitored. Hunting camps and old homesteads within the interior of the park will be considered source sites, but will not be surveyed.

When traversing the trail, a good stopping point to end the survey is where there is low disturbance or lack of exotic species, an absence of rest areas or campgrounds, and where the habitat is pristine as far as one can see on both sides of the trail. In most cases this is attained about 0.5 to 1 km down the trail.

Campgrounds – The entire campground area, including dump sites, will be surveyed. In many instances, campground roads can be monitored by the roadside survey method of driving at idle speed. However, some campgrounds are best surveyed by foot as vegetation is usually tall and dense, limiting viewing area to approximately 3m from truck. Viewing area is increased to approximately 5-6m and smaller plant species such as grasses and forbs are more visible using the walking survey method. Special care should be taken to survey the campground dump sites and cleaning areas as many species are washed from vehicles and become established in the area.

Field of View Estimate – Walking Survey

Hiking Trails – Most hiking trails are not accessible by vehicle and are usually densely vegetated, making the roadside survey method unsuitable or prohibited. Vegetation along a trail will change depending on the habitat or changes in habitat. For more open habitats like open woods, field of view for plants 1m tall or more is good to approximately 15m. For vegetation 0.5m to 1m in height, the field of view is good to approximately 10m, while plants less than 0.5m in height are readily visible to only about 1m from the trail (Figure 15). So on the data sheet the observer would typically record 10m. Exotic shrubs and trees outside this field of view are still recorded but specified as such in the comments.

Surveying the more densely vegetated areas such as shrublands or forests, the field of view is good to approximately 10m for vegetation over 2m in height. Vegetation 1m to 2m in height is visible to about 5m, while plants less than 1m in height or ground cover are visible 1-3m from the trail (Figure 16). So on the data sheet the observer would typically record 5m as an approximation of the two or whatever the observer feels confident with readily observing all strata. Exotic shrubs and trees outside this field of view are still recorded but specified as such in the comments.

Figure 15. Field of view along hiking trail in open woods, in this case a Buttonwood woodland. The taller trees and shrubs have clear visibility to about 15m or more from the hiking trail. The lower statured herbs and shrubs, in this case saltwort, have clear visibility to about 10m from the hiking trail. So on the data sheet the observer would typically record 10m. Exotic shrubs and trees outside this field of view are still recorded but specified as such in the comments.

Figure 16. Field of view in densely vegetated shrublands. The taller trees and shrubs over 2m in height are clearly visible to about 10m from the hiking trail. Vegetation lower than 2m in height are visible to about 5m from the hiking trail. Vegetation less than 1m in height are only visible along the edges of the trail, about 1-3m. So on the data sheet the observer would typically record 3m or whatever the observer feels confident with readily observing all strata. Exotic shrubs and trees outside this field of view are still recorded but specified as such in the comments.

Trail Heads – Areas that have the greatest potential for exotic plants to establish, and where the most exotics were found in our pilot study, were at the beginning of trails (trail heads), especially if they were in close proximity to main roads (Figure 17). For this reason trail heads should be searched meticulously by foot for new introductions of exotic plants. These are areas of high visitor use and usually there is an absence of refuse receptacles, so items are generally discarded at the trail head.

Figure 17. Example of a trailhead. Most exotic plants encountered are at the trailheads, especially if they are near main roads.

Airboat Surveying

Boat Launches – Within park boundaries, boat launches and the immediate surrounding area where people may throw garbage away and where birds may roost will be surveyed. Walking surveys would be the preferred method at the landed portion of boat launches. Airboat surveys should be used to survey the surrounding waters of airboat launches. Special care should be taken when surveying airboat boat launches as these areas occasionally dry out and allow for seed germination, especially grass seeds.

Airboat Trails – Main airboat trails, especially those originating from main roads such as Tamiami Trail, are surveyed from an airboat traveling at idle speed from trail origin into the park for 1 km (Figure 18). The surveyed area may be lengthened if new invasions are discovered in close proximity to the end mark. Airboat surveys start at main airboat launches and extend for 1km along main airboat trails from the launches. Exotic plants are more likely to occur at the airboat launches themselves, so extra time and effort should be spent surveying these areas before proceeding in the airboat. Once the airboat is launched, proceed at idle speed along main airboat trail. A team of two, an airboat operator and a botanist, are needed to perform the airboat survey. While the airboat operator proceeds at idle speed, the botanist is on the lookout for early invasions of exotic plant species along the main airboat trails, which may act as corridors into the parks.

If no new exotic plants are located, then the survey for that airboat trail is halted at 1km from the airboat launch. If, however, a new exotic plant species is found along the survey route, then an additional 500 m is surveyed along the main airboat trails. This process is continued until an entire 500 m survey is found to have no new exotics.

Figure 18. Example of airboat trail surveying. Most exotic plants encountered are at the boat launches. A botanist surveys the area for new exotic plant species while travelling at idle speed.

Canals – Canals originating at the edge of the park and continuing into the park interior for 500 m or more will be sampled by airboat at idle speed. Special care should be taken to sample submerged aquatic plants for new invasions of exotics. To accomplish this, a dip net or hook could be utilized to pull up mats of submerged aquatic plants to test for exotic species. Submerged aquatic plants should be sampled six times during the length of survey starting at the 0m mark and again every 100m. In many cases the submerged aquatics will be visible from the airboat and infestations could be sampled upon sight in addition to the 100m sampling interval. During survey, adjacent levee road edges descending to the canal will be monitored as well for new species of exotic plants. Levee roads paralleling canals starting at road origin and continuing into the park interior for 500m and perhaps at frequently visited areas along the levee road should be sampled by truck and/or by foot.

Motorboat Surveying

Motorboats will be used for transportation to campsites in Everglades National Park and to the offshore islands in Biscayne National Park. Once at campsites, they are monitored by foot. Other than for transportation, motorboats are not used for surveying.

Data Handling, Analysis and Reporting

Data base design and data entry

Data sheets are scanned and stored in a 3 ring binder in the SFCN Conference Room. Scanned copies are placed in Z:\SFCN\Vital_Signs\Invasive_exotic_plants\data\Data_sheets.

Refer to "Standard Operating Procedure D – Data Entry" for details on data entry, photo naming and storage conventions, and waypoint and trackline naming and storage conventions. The Corridors of Invasiveness database is designed as a Microsoft Access database, based on the Natural Resource Database Template that is also a personal geodatabase and stores three general types of data:

A) Field data (see "A" in Figure 19) – This data is manually entered directly into the Microsoft Access database. See "SOP D – Data Entry" for details on data entry.

B) Spatial Data, i.e.,Waypoints and Infested Area Shapefiles (see "B" in Figure 19) –The Waypoints shapefile holds raw GPS data and any new waypoints data must be appended to this shapefile. Infested Areas shapefile contains infested area polygons created during post processing and analysis. This process is described in detail in "SOP E – Uploading and Downloading GPS, Appending Waypoints and Tracklines, and SOP F- Analysis". GPS tracklines are also stored in the database but are not linked to any other tables.

C) Photo data entered via ThumbsPlus 7.0 interface (see "C" in Figure 19) – Photos are directly downloaded from the camera to the server. From the server the photo data is

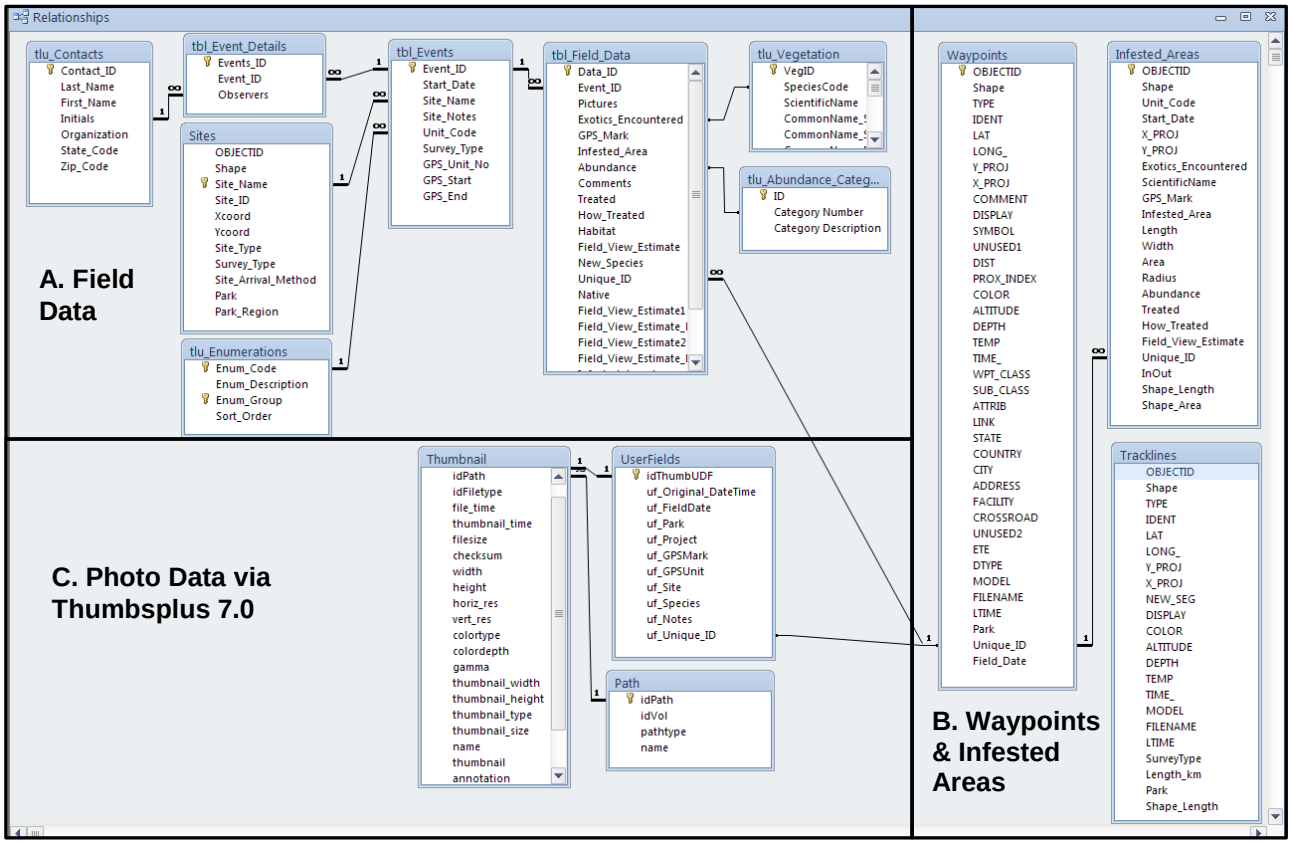

Figure 19. Three main portions of database design showing A. Field Data component, B. Spatial Data: Waypoints and Infested Areas, and C. Photo Data entered via ThumbsPlus 7.0.

entered into the Microsoft© Access database with ThumbsPlus 7.0 software, and photos and their data tied to the waypoint and field data.

Detailed descriptions of table fields are given in Appendix E.

Completed field data sheets should be entered into the Access Database as soon as possible after returning from the field, while details from the field are still fresh on the mind of the researchers. Cameras ("SOP D – Data Entry") and GPS units ("SOP E – Uploading and Downloading GPS, and Appending Waypoints and Tracklines") should be downloaded to the correct folders on the server. Photos are then imported into a ThumbsPlus database where each photo is linked to user field data and to a specific point within the park.

The Access database is designed to resemble the field data sheet (Appendix B) for ease in entering the data. The details of data entry procedures for the Access database are provided in "SOP D – Data Entry."

Quality Assurance/Quality Control

If a species is unidentifiable in the field, a sample is collected for identification at the office using books, dichotomous keys, websites, etc. If a new exotic species is suspected, a specimen is taken to another expert for verification.

The database has automated checks built-in such as a restricted list of species codes which will pop-up a message if the species is not on the list and will take the user to a new form where they can enter a new species. New GPS waypoints must be appended into the database first to allow remaining data entry. Lookup lists for site names, abundance and other fields are used where appropriate.

Once data is entered into the Access database, a printout of that data is then given a 100% check for accuracy compared with the field data sheets by someone other than the person who entered the data.

Analysis

The most important results of this protocol require minimal analysis, i.e., the types, locations, and infestation size of invasive exotic species, with an emphasis on species new to the park. Once all the data is entered, such results are easily exportable as queries and reports from the database.

Although of lower importance, two types of trends may be of interest from this protocol: 1) spatial trends which show changes in the distribution of species and patterns of invasion in/along corridors, and 2) percent infested area which can be used for comparison among different areas of the park and along different types of corridors as well as changes through time.

Estimates of the percent of infested area surveyed require additional work which is detailed in "SOP F – Analysis".

- In ArcGIS, the tracklines and waypoints are displayed together with aerial imagery.
- The corridors monitored are digitized using the GPS tracklines shapefile as a guide to create a new line shapefile running down the center of the road, trail, etc. surveyed.

- The digitized line is buffered based upon the "Field of View" estimate.
- The waypoints themselves are buffered by the size of the area of the infestation present to create a new shapefile for the infested areas.
- The observer reviews the new infested areas shapefile.
    - As some infestation locations were estimated from the roadside, locations are reviewed together with aerial imagery. If necessary they are moved to match the aerial imagery.
    - If the infested area is greater than 1000 m^2, the observer reviews these areas and decides whether they need to be redrawn/digitized based on the aerial imagery.
    - In cases where the infestation is large and has areas both inside and outside the high confidence field of view corridor, the polygon is split where the overlap with the high confidence field of view buffer occurs. This creates two polygons that remain linked to the same waypoint with one polygon labeled as "inside" the field of view and the other "outside". Only the "inside" polygon will be used for percent infestation calculations. The original field estimate will remain unchanged.
- Percent infested area is calculated by taking the area of infestations "inside" the field of view buffer and dividing by the total area surveyed (total digitized line buffered area). Calculations are made by species and across all species.

CAUTION: These infestation area estimates are rapid, the digitization of large polygons is approximate, and estimates of field of view are approximate and it is possible for the area surveyed to shift a small degree through time. Thus users of these metrics should only focus on large differences in percent infested area (e.g., order of magnitude) rather than small changes. As this metric is of lower priority, additional precision is not considered worth the additional workload or additional analysis time that would delay delivering reports to managers.

These digitized survey lines with buffers, tracklines, and resulting shapefile will be stored in the database and can be used to assist future field crews conducting repeats of the surveys. Overlaying of new tracklines with the previously digitized survey lines will allow quick highlighting of changes in the surveys which may need to be mentioned in any assessment of trends, e.g., surveys were continued further down trails as exotics were still found near the 100m cutoff from the trailhead. Future digitization will only need to focus on these changes rather than a complete re-digitization of all track lines.

After the first round of sampling of all the parks, the effectiveness of the sampling design can be assessed by using the following questions:

- How many new species and infestations of existing species were detected and what types? How many are considered potentially problematic species? What is their spatial distribution within the parks "corridors"?
- What type of "corridors" and areas of the parks resulted in the most new species detected and greatest infestation? What type resulted in little to none?
- What areas of the park have the greatest percent infested area within the corridors? How great a difference is there in percent infested area within different areas of the parks and types of corridors and among different species?
- How much time did the protocol require compared with initial estimates?

After two rounds of sampling, the following questions can be assessed:

- Did the number and size distribution of infestations change for different species? Did the percent infested area of the new and existing exotic species change by large amounts between the two visits?
- What is the pattern of spread of new species in/along "corridors? Or was distribution static or reduced after the previous sampling? What areas are most problematic for re-infestation? Is there a shift in the areas where the most new species and new infestations are detected?
- How large are new infestations by the second visit? Is the frequency of visits appropriate for catching infestations early enough to treat effectively?

These questions can be used to evaluate if there are sites which can be dropped from further sampling or areas that should be added; whether the frequency of re-visit is appropriate; whether percent infested area is a useful metric at the precision level possible; and whether the number and type of new species detected and size of the infestations coupled with labor and treatment costs show that this type of monitoring is cost-effective in assisting overall invasive/exotic plant control.

Reporting

There are four main types of reporting associated with this protocol:

- Routine annual data summary reports to the park surveyed in a particular year. Individual infestations are reported together with waypoint information, infestation area, abundance, field of view estimate, treatment data, and comments. Summary data is also reported by species, whether it's new to the park, the number of infestations, minimum size of infestation found, maximum size of infestation found, total area, and percent infested in the field of view. Maps and photos are included. Details for creating these reports can be found in "SOP G – Reporting". A sample summary data report template can be found in Appendix D. The completed field report is then sent via email to the corresponding park and to the EPMT coordinator approximately two to four weeks after completion of field work. In Everglades National Park (EVER), the reports should be sent to park botanists, and the park lead biologist. In Big Cypress National Preserve (BICY), the report should be sent to the park botanist, and to the park Resource Management Chief. In Biscayne National Park (BISC), the report should be sent to the Resource Management Chief and to park biologists.
- Data will be uploaded into the Early Detection and Distribution Mapping System (EDDmapS Mapping Project) at www.eddmaps.org. Reporting to EDDmapS is normally done upon completion of field work; however, when a new species or new infestation is discovered, it should be reported to EDDmapS as soon as possible.
- The corresponding park should also be notified within 1-2 days when a new species or unusual infestation is discovered, i.e. by email, phone, or in person.
- The National Park Service database NPSpecies will be updated with new exotic plant species. Reporting to NPSpecies is done after completion of field work and when all species are verified.

Reports will then be uploaded to Integrated Resource Management Applications (IRMA.nps.gov) and the SFCN webpage and included in annual vital signs reporting.

Metadata and Data Archival Procedures

All metadata pertaining to the database and spatial files will be updated as changes are made but will be reviewed and finalized at the end of the calendar year and follow the guidelines for metatdata in Chapter 8 of the SFCN Network Data Management Plan (Witcher 2007).

Initial archiving is started once the SFCN botanist has conducted the appropriate QA/QC procedures for a specific field season, has completed the annual data summary report, and has notified the network data manager that the dataset is ready for archiving. The target archive date is the end of the calendar year. At this point the network data manager places a copy of the dataset into the appropriate folder within the archive directory on the network server with appropriate accompanying metadata. For example, the database and version of protocol used that year are copied onto the network server under:
Z:\SFCN_Archive\Vital_Signs\Invasive_exotic_plants\Corridors\yyyy
where yyyy is the relevant year.

Once the database is archived, any changes made to the data are documented in an edit log. Secure data archiving is essential for protecting data files from corruption. Backup copies of the database are maintained at the South Florida office and at the Southeast Regional office in Atlanta, GA. For further detail of the archiving procedure please refer to the SFCN Data Management Plan.

Datasheets are stored in a protocol 3-ring binder in the SFCN conference room.

Voucher Specimens

Voucher specimens collected in the field are initially stored in a plastic ziplock bag with notes describing the location where the plant was found, including coordinates, and descriptions about the plant and the habitat in which it was found. If specimen cannot be processed (identified, pressed in a plant press) immediately, then specimen can be kept in ziplock bag under refrigeration for up to two days. The voucher specimen is then placed in a plant press and arranged in a way that all parts of the plant (stems, leaves, flowers, fruits) are easily discernible. The plants name, family, location and habitat descriptions are then typed up and included with the plant specimen within the plant press. Voucher specimens and associated data are periodically delivered to the South Florida Collection Management Center at Everglades National Park.

Personnel Requirements and Training

Roles and Responsibilities

This protocol calls for the identification and treatment of new infestations of exotic plants. To accomplish this goal, a trained botanist and a certified applicator make up the field crew. As such, each team member should be properly trained in their respective duties. The botanist is responsible for identifying exotic plants and recording data associated with the infestations of exotic plants. The EPMT technician is responsible for vehicle operation and proper handling and use of herbicides for treatment of small populations of exotic plants. The SFCN Data Manager, in cooperation with the SFCN Botanist, oversees the database design, building in adequate quality control procedures into the database, maintaining data security and archiving. Table 3 (page 11) provides additional detail on roles and tasks.

Personnel assigned to data collection, analysis and storage shall be properly trained in the procedures relevant to the assigned tasks. Responsibility of proper adherence to procedure, quality control and quality assurance rests with all pertinent personnel.

Rules and regulations applicable to the performance of these tasks shall be observed, with particular note to individual park policies.

Nothing in this protocol is implied or meant to imply deviations from established federal, departmental or local safety rules and regulations applicable to the performance of assigned tasks. It is the responsibility of each individual to be familiar with such rules and regulations.

Qualifications and Training for the SFCN Botanist Position

For this protocol, the botanist is the team leader and should have a comprehensive knowledge not only of the South Florida flora, but also knowledge of the National Parks of South Florida (Big Cypress National Preserve, Biscayne National Park, and Everglades National Park). Training should include college course work with a concentration in botany and/or the equivalent in work experience. However, the level of knowledge of South Florida flora should be sufficient that the botanist can readily identify most species and quickly identify likely new exotic species. Knowledge of the National Parks themselves is imperative to know where the site locations are and how to navigate to them, as well as knowing the areas of the park that may be more susceptible to exotic plant invasions.

Qualifications and Training for the EPMT Technician Position

To work in the National Parks in Florida, the applicator should have received an Applicator License from the Florida Department of Agriculture and Consumer Services Pesticide Certification Office. This training includes mixing of pesticide concentrates, equipment care, application precautions, pesticide storage, transport, and disposal, as well as safety, emergency procedures, and first aid. In addition to this training, the applicator should also attend the Natural Area Weed Management training, which covers pesticide use in natural areas.

Training

Personnel should thoroughly review this protocol and any associated Job Hazard Analyses (JHA's) before implementing procedures.

In many cases, the sampling sites can only be arrived at by motorboat, swamp buggy, airboat, or ATV. The botanist and the applicator should have training in the use of all these vehicles.

- MOCC (ref 36 CFR part 3, 485 DM 22) (necessary if driving an NPS boat)
- MOCC Airboat Safety Module
- ATV training
- Swamp Buggy training

The intent is that this protocol will be the responsibility of the SFCN Botanist, which is a permanent SFCN staff position, who will be personally conducting the surveys rather than a seasonal or temporary employee who would need detailed training each year. However in the case of staff turnover or if park staff wish to implement this protocol during "off" years, new personnel will be accompanied by SFCN and/or EPMT staff experienced with this protocol, the parks being worked within, and use of equipment.

The SFCN Botanist is expected to seek ongoing training and knowledge about south Florida botany. Each year the botanist also downloads EDDMapS information on the assigned park to see if there are new species reported and also consults with the EPMT Specialist to learn of new exotic species to be aware of and familiarizes him/herself with these plants.

Although data entry procedures are addressed in SOP C, any questions with regards to data entry and verification procedures should be directed to the SFCN Data Manager. Data entry by new personnel would be done the first time while accompanied by experienced personnel.

Operational Requirements

Annual workload and field schedule

Monitoring can be conducted at any time during the year; however, spring or fall months are preferable due to flowering times which make identification easier. Flowering broadleaf plants generally flower in the spring, while grasses generally flower in the fall months. Reporting of new species and/or problematic infestations occurs as soon as possible to park resource management and the EPMT specialist. Generally the annual data summary report should be completed approximately 8-12 weeks after completion of field work. Data archiving should typically occur in December/January. Table 3 (page 11) provides additional detail on the schedule.

Two people minimum are required for the field work; a vehicle driver (truck, airboat, motorboat) and a trained botanist. The driver should be someone from the Exotic Plant Management Team (EPMT) who also has the duty of treating small infestations of exotic plants. If a member of the EPMT is not available, then another staff member may substitute in driving the vehicles if properly trained, but no herbicides will be used. To drive the truck, a valid driver's license is required; however, Motorboat Operator Certification Course (MOCC) training is required to operate a motorboat or airboat. Three to four weeks of field time per year are required for the two man team to complete the field work portion of the project. Another three weeks per year is required for the two man team to input data, check data, and write the summary report. Another three weeks per year is required for the GIS specialist and the data management/outreach technician to check databases, make corrections as needed, and assist with writing summary reports. This amounts to forty-five days per year allotted time to complete this project in a given year.

Facility and equipment needs

Following is a general list of equipment needed for this project:

- A vehicle from the South Florida/Caribbean Network's fleet. In many cases, one of the towing vehicles is needed to trailer the motorboat or airboat. SFCN fleet vehicles are maintained on a regular maintenance schedule with each vehicle assigned to a specific SFCN staff member in charge of that vehicles maintenance.
- Motorboat or airboat including boating safety equipment. Safety equipment includes personal floatation devices (PFD's), first aid kit, whistles and flares, depth charts, and ear protection like earmuffs (required for airboat operation). For work in Florida Bay near Flamingo, the Flamingo Ranger Station can be called (239-695-3094) for motorboat operator assistance. For work in the western Everglades region, the Gulf Coast Ranger Station can be called (239-695-4217) for motorboat assistance. In both cases, a park ranger may be able to assist with motorboat transportation needs based on their availability. In case of emergencies, first contact Everglades dispatch (305-242-7740) either by phone or by park radio. Then call the office (305-252-0347) to report the emergency. SFCN boats are maintained on a regular maintenance schedule with each boat assigned to a specific SFCN staff member in charge of that boat's maintenance.
- Field gear including datasheets, pencils, sharpies, ziplock bags or plant press for plant specimen collection, a park radio, camera, GPS unit, and large water container (5 gal.).

- Equipment for treating exotic plants. This includes the chemical sprayers, storage containers, the chemicals, and machetes for girdling trees. Chemicals used in this project are Garlon 4 for woody plants and glyphosate for herbaceous plants. The chemical applicator is required to wear rubber gloves, eye protection, long-sleeve shirt, boots with socks, and long pants for protection from chemicals. Also, cautionary equipment such as orange vests, roadside caution signs or orange cones, and magnetic orange strobe light should be used.

Startup costs and budget considerations

Since most of the equipment used (see above) has already been purchased for other vital signs and projects, no substantial startup costs are included here. Budget considerations include fuel and maintenance for the vehicles and boats plus salary considerations for the botanist, EPMT technician, and the data management specialist (Tables 4). These costs will vary from year to year depending on the sites. Sites in the western Everglades region (Figure 5) will require more fuel for both the truck and the motorboat than for the eastern Everglades region (Figure 5), which requires less motor boating and is closer to the office. Costs for herbicide and associated equipment are covered by EPMT.

Table 4. Project budget estimates per annual sampling event. Budget estimates are based on 15 field days. *Note: These costs are approximate based upon initial surveys and 2013 salary estimates.Costs of boats, ATVs, trailers, vehicles, computers, software, etc. are not included. Travel costs within the parks will vary depending on type of transportation used and distance.*

Expense	Time	Cost
Botanist (GS-7 Step-6)	45 days	$ 3,756
Technician (GS-7 Step-6)	15 days	$ 1,252
Data Management/Outreach Specialist (GS-7 Step-6)	15 days	$ 1,252
Fuel and Vehicle Maintenance	15 days	$ 2,000
Herbicide	15 days	$ 500
Total Cost		$ 8,760

An estimate of personnel time for field and office work (Table 5) can be broken down as follows:

Sixty-five work days at a GS-7 step 6 level (SFCN Botanist at 45 days and EPMT Technician for 20 days) (SFCN supplies ¾ of this time, EPMT supplies ¼ of this time)
Twenty-five work days at a GS-7 step 6 level (Data Management/Outreach Specialist)

Software required include: MS Access 10, MS Word 10, MS Excel, Adobe Acrobat, ThumbsPlus 7.0, ArcGIS 10. These software are used across multiple protocols and projects.

Table 5. Project time estimates per annual sampling event. Time estimates are based on 15 field days.

Position	Duty	Time
Botanist (GS-7 Step-6)	Pre-field preparations	5 days
	Fieldwork - Surveys	15 days
	Data Entry	5 days
	Data QA/QC	5 days
	Reports	15 days
EPMT Technician (GS-7 Step-6)	Pre-field preparations	5 days
	Fieldwork - Surveys	15 days
Data Management/Outreach Specialist (GS-7 Step-6)	Pre-field preparations	5 days
	Data QA/QC	5 days
	GIS files cleanup	5 days
	Report tables and figures	10 days
Total Time		85 days

Safety

Personnel must review the respective SOPs, Go-No Go checklists, safety signout sheet, and radio ID sheet associated with this protocol. They must also review and sign all Job Hazard Analyses associated with this protocol. These SOPs and JHAs are located in the SFCN Safety SOP & JHA Binder. Electronic versions are available on the SFCN server at Z:\Safety\ with filenames given by protocol in SFCN_Safety_SOP_and_JHA_Binder.pdf. These documents are also available in Appendix C of this protocol. However users should check for updated versions in Z:\Safety\. Although every attempt will be made to keep this protocol current, it's possible for a delay to occur between updates of a Safety SOP in Z:\Safety\ and updates of this protocol.

All NPS-SFCN personnel will follow the Safe Practices Manual and Emergency Operations Plan specific to the respective park they are operating within.

In many cases, the sampling sites can only be arrived at by motorboat, swamp buggy, airboat, or ATV. The botanist and/or the applicator should have training in the use of all these vehicles.

- MOCC (ref 36 CFR part 3, 485 DM 22) (necessary if driving an NPS boat)
- MOCC Airboat Safety Module
- ATV training
- Swamp Buggy training

Completion of the Department of Interior's Motorboat Operator Certification Course (MOCC) is required for the solo operation of an NPS vessel. Non-certified MOCC personnel may drive a park boat under the supervision of an MOCC certified operator.

In general an attitude of a "culture of safety" and "operational leadership" should prevail in which problems are considered proactively and each person must feel empowered to think about potential problems and speak up early and act upon safety concerns regardless of their position and those concerns must be addressed seriously and respectfully by management.

Nothing in this protocol is meant to imply deviations from established federal, departmental or local safety rules and regulations applicable to the performance of assigned tasks. It is the responsibility of each individual to be familiar with such rules and regulations. Personnel must follow any park specific requirements, and any other requirements of the National Park Service not otherwise specified herein.

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Standard Operating Procedure A – Preparation for Field

(Version 1.0)

Version #	Date	Revised by	Changes	Justification

Purpose

To ensure proper data collection in the field, it is imperative to be prepared and have all necessary equipment checked and in good working order.

Procedures

Before each scheduled field excursion, proper preparation is essential to collecting good data. Below is a guideline list of the items that need to be taken care of before fieldwork:

- GPS units should be uploaded with all the survey area points (see SOP D – "Uploading and Downloading GPS"). When uploading or downloading waypoints, make sure that the projection settings are set to NAD 83 and that the UTM setting is set at 17N. It is important to start new waypoints where you left off from the previous survey. For example, if the last waypoint recorded for the 2011 survey was 095, then you would want to use waypoint number 096 at the start of the 2012 survey and count up from there. Follow this process for succeeding years.
- Field sheets (Appendix B) are prepared on all-weather writing paper.
- Check for the latest EDDMapS exotic plant listing for the park to be surveyed. This is useful to see if anyone has reported any rare or unusual exotics for the park (see SOP G – Reporting, section "Import Data from EDDMapS").
- GPS units, park radios, and cameras need to be fully charged.
- Plant presses, pencils, sharpies, vascular plant guide, and associated maps need to be packed, usually in a small action packer to keep everything together.
- Pack mosquito suits, mosquito repellent, rain gear, a substantial lunch, and plenty of water (1 gallon per person per day is a good rule of thumb).
- Vehicles need to be checked to make sure they are in proper running condition and fully fueled for each field day. Vehicle Go/No Go checklists are in Z:\Safety\ and in Appendix C (use Z:\Safety\ version as updates will occur there first).
- Safety gear such as the strobe light for the truck (place on roof of truck when surveying roads), orange safety vests (wear when walking roads), and a First Aid kit should always be available within the truck.
- Personnel should know how to use the park radios and verify they are charged and the Radio ID sheet is within the radio box before leaving the SFCN office.
- If using ATVs, airboat, or motorboat, the appropriate Go/No Go checklist must be followed and is provided in Z:\Safety\ and Appendix C (use Z:\Safety\ version).

- If EPMT personnel will be participating, then EPMT should include
    - Manual Control of Non-native Plants in Natural Areas of Florida (Langeland 1997) or another credible source.
    - The training manual, Natural Area Weed Management (Langeland 2001)
    - Premixed hand sprayer bottle of 10% Garlon 4 (triclopyr) and oil
    - Premixed hand sprayer bottle of 5% Rodeo/Roundup (glyphosate) and water
    - Appropriate personal protective equipment (PPE) while treating and handling the chemicals. The proper PPE will be stated on the label of the specific herbicide being used but generally this consists of long pants, long sleeved shirt, close-toed shoes, eye protection, and chemical resistant gloves.
    - Any other equipment required by the EPMT program
- Inspect and decontaminate vehicles for possible seed sources such as caked on mud, plants, and seeds themselves before going into the field. This will prevent the field crew from becoming a vector of exotic plant dispersal.
- Always check the weather conditions and forecast before leaving the office and use good judgment based upon the mission. Deteriorating weather conditions can be the most dangerous as they can rapidly change a "Go" to a "No-Go" situation.
- Prior to each field trip, Everglades dispatch (305-242-7740) must be called to report who you are, where you will be working, emergency contact information, and estimated time of return from the field. As a secondary precaution, the office emergency field sheet must be filled out (provided in Z:\Safety\ and Appendix C (use Z:\Safety\ version)) identifying field members and their cell phone contact numbers, which park and area of the park you will be working, estimated time of return from the field, and time to start calling for help if the field crew does not call in stating they have returned from the field. This is not only posted by the office entrance but a person (typically the administrative assistant and/or the Community Ecologist) should be informed who is responsible for making sure the field crew has returned.
- It is the responsibility of all personnel to implement Operational Leadership and speak up and act if a situation is felt to be or may become unsafe.

Literature Cited

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Langeland, K.A. and R.K. Stocker. 1997. Control of Non-native Plants in Natural Areas of Florida. Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. SP 242. Available from http://edis.ifas.ufl.edu/WG209 (accessed July 28, 2011).

Standard Operating Procedure B – Survey Methods

(Version 1.0)

Version #	Date	Revised by	Changes	Justification

Purpose

To document procedures for filling out the field data sheet. Descriptions of the different surveying (road, walking, airboat) methods and how to establish field of view estimates are found in the main body of the protocol in the Field Methods section.

Procedures

All work done in the parks can only take place after calling in to Everglades dispatch (305-242-7740) to report who you are, where you will be working, emergency contact information, and estimated time of return from the field. At the end of every field day, the field crew must call in to Everglades dispatch and the home office to report that they have returned from the field and are done for the day.

Upon entering the park, turn on GPS units to start gathering track data.

The type of survey planned at each site (road survey, walking survey, airboat survey) is provided in Appendix A – "Site Selection List". The details of the different survey methods are provided in the "Field Methods" section of the main document and include:

Road Surveying
Walking Surveys
Airboat Surveys

The user is referred to that section for details of these methods.

When a "site" is reached, if a road survey is to be conducted, the strobe light is attached to the roof of the vehicle and turned on. If a walking survey along roads is to be conducted, personnel put on orange safety vests and put laminated SFCN Identification Sheet in window of vehicle. (Safe operation of ATVs, airboat, and motorboat are covered under respective training).

Details for filling out the field data sheet are below. A new field data sheet is initiated for each corridor survey "site" (see Appendix B – Field Data Sheet). Data sheet field descriptions include:

- **Date** – Enter the date that the fieldwork was completed.
- **GPS Unit #** – Enter the number given to the GPS unit that was used in gathering field marks. Each of the handheld GPS units owned by SFCN has been given a number, which is written in multiple places with a sharpie on the unit itself. Sometimes, however, the number will get rubbed off the outer casing of the GPS unit. When this happens just open the cover to the battery storage area of the GPS unit, and the unit number will also be written there as well.

- **Starting GPS Mark** – This is the mark taken at the beginning of a survey to denote the starting point of the survey. This mark is important in determining distance travelled during that particular survey, as well as having a beginning mark to illustrate on field report maps.
- **Ending GPS Mark** – This mark is taken at the end of the survey. This mark is important in determining distance travelled during that particular survey, as well as having an ending mark to illustrate on field report maps.
- **Park** – Enter the four letter code name for the National Park in which the survey occurred.
- **Site** – Enter the site within a National Park where the survey occurred. For example, if the survey took place in the Flamingo campground area of Everglades National Park, then Flamingo campground would be entered in this data field.
- **Observers** – Enter the initials or the names of the individuals that took part in the survey.
- **Comments** – Enter any comments, remarks, or notes taken in the field. This may include site descriptions, observations, or any item of interest pertaining to the survey area.
- **Survey Type** – Circle the type of survey method used (Walking, Driving, Airboat, Driving/Walking). Sometimes, when doing a driving survey, it is required to get out of the vehicle and finish the survey by walking. In this case the Driving/Walking survey type is chosen.
- **Species** – Enter the six letter species code of the exotic species encountered during the survey. The six letter code consists of the first three letters of the genus and the first three letters of the specific epithet to come up with the species code. For example, *Schinus terebinthifolius* (Brazilian pepper), would have a species code of SCHTER.
- **GPS Mark** – Enter the GPS mark that corresponds to the exotic species encountered.
- **Infested Area** – Enter the estimated size of the infestation. This is usually entered in the form of some amount of meters wide by some amount of meters long (i.e., 3 x 3). Enter as Length (m) and Width (m) on the data sheet.
- **Abundance** – Circle the appropriate category number:
    - **1= 1 individual**
    - **2= 2-5 individuals**
    - **3= 6-10 individuals**
    - **4= 11-15 individuals**
    - **5= >15**
- **Comments** – Comments such as specific abundance or if infestations are outside field of view estimates.
- **Treated** – Check this box if the exotic plant encountered was treated (sprayed with Garlon, sprayed with glyphosate, or pulled out of the ground) in the field.
- **Treated With** – If the species encountered was not treated in the field, then leave this data field empty. Otherwise, enter whether the exotic was treated with Garlon, glyphosate, pulled out, or any other means of eradication.
- **Habitat** – Enter the habitat in which the infestation is taking place.

- **Field of View Estimate** – Enter the estimated field of view from the road or trail. Circle the direction and enter the field of view estimate in meters in both directions to either side of the road or trail. This is the distance in meters one feels one can confidently view without too much obstruction for the purpose of sighting exotics in all three canopy layers (herb, shrub, tree).
- **Pictures** – Enter the number of pictures taken that corresponds to the exotic species encountered.

Take GPS marks for beginning and ending of surveys and for any place where the field of view substantially changes, e.g., from 10 to 20m, and these are recorded on a line on the data sheet (species & infestation information are left blank). The Field of View is the distance in meters one has reasonably high confidence one can view without too much obstruction for the purpose of sighting exotics in all three canopy layers (herb, shrub, tree). Field of View is estimated separately for each side of the corridor and the direction circled.

Exotics can and should be recorded that are outside this high confidence field of view, however they should be marked as such and approximate distance given in the comments (e.g., if the observer sees an Australian pine that is 50m away and outside the high confidence Field of View, it should be recorded and an approximate distance and direction given (e.g., north 50m, Outside FV). Typically this only occurs for trees and tall shrubs.

For large infestations of exotics along a long length of the corridor (e.g., 400m), take a GPS mark at the beginning of the infestation and the end of the infestation so the distance can be accurately calculated and record both on the data sheet together with information on the exotics. If part of the infestation is likely outside the field of view, mention this in comments, e.g., part outside FV, so this can be dealt with in the post-field processing/analysis step.

Details for steps taken when an exotic is encountered are described in SOP C – When Exotics are Encountered.

Standard Operating Procedure C – When Exotics are Encountered

(Version 1.0)

Version #	Date	Revised by	Changes	Justification

Purpose

This SOP provides guidelines regarding field methods when exotic plants are located during the survey. This includes taking GPS marks, feasibility of treating infestations, and procedure for treating exotics in the field.

NOTE: Herbicides are only to be applied by trained EPMT personnel and only in accordance with the EPMT program guidelines, procedures, and safety requirements. These requirements are not covered in this document as they are documented and kept current by the EPMT program. Nothing stated below is meant to replace or supersede EPMT program guidelines, procedures, and requirements.

Procedure

When a new exotic species is found, it is marked on the GPS unit and the data sheet (Appendix B), identified to species, size of the infestation and number of individuals in the infestation is noted, and the community type where the infestation is occurring is recorded on the data sheet (Appendix B). When all the information has been gathered, then photos of the species and the infestation are taken and photo numbers are recorded on the data sheet. After photos are taken, the plant should be collected and pressed in a plant press. In the case of small infestations of only a few individuals, the surveyors may eradicate the population of exotics by pulling them out of the ground by the roots, or if EPMT personnel are present, by applying an herbicide to the infestation. Large infestations that may take longer than ten minutes to eradicate will not be dealt with by the surveyors, but reported to the park botanists and to the EPMT. The corresponding park should also be notified the day a new species or infestation is discovered.

On Site Exotic Plant Treatment

When onsite treatment is considered practical, the treatment method of the discovered exotic species should be referenced from the manual Control of Non-native Plants in Natural Areas of Florida (Langeland 1997) or another credible source. If the species is not listed in published literature and no common knowledge exists from the applicator, a general treatment of 10% Garlon 4 (triclopyr) and oil will be used for all woody stemmed plants and 5% Rodeo/Roundup (glyphosate) and water will be used on any herbaceous plant species. These two herbicide mixes will be premixed and placed in hand sprayer bottles for quick application. Treatments consist of basal barking woody stemmed species with the 10% Garlon 4 mixture by spraying the circumference of the base of the trunk/stem up to 20 inches from the ground and foliar spraying herbaceous species with the 5% Rodeo/Roundup mixture on 75% or more of the plants vegetation. Retreatment and/or post observation may be required to confirm effective treatment of new species. All onsite applicators, when using herbicides, will be required to wear

appropriate personal protective equipment (PPE) while treating and handling the chemicals. The proper PPE will be stated on the label of the specific herbicide being used but generally this consists of long pants, long sleeved shirt, close toed shoes, eye protection, and chemical resistant gloves. Applicators will need to comply with local and federal laws according to the specified label of each herbicide to prevent over application and ensure correct use of each herbicide. The training manual, Natural Area Weed Management (Langeland 2001), will be used as a guide for application methods, correct use, and safety procedures.

Literature Cited

Langeland, K. A. 2001. Natural area weed management: A training manual for restricted use pesticide applicators. Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville.

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Standard Operating Procedure D – Data Entry

(Version 1.0)

Version #	Date	Revised by	Changes	Justification

Purpose

To describe procedures for downloading photos from the camera, entering photo data via ThumbsPlus7.0 into the MS Access database, and entering field data into the MS Access database.

Procedures

Photos

Photos should be downloaded into the folder Z:\SFCN\Vital_Signs\Invasive_exotic_plants\images. Photos are then imported into ThumbsPlus where each photo is linked via the MS Access database to field data and to a specific point within the park.

Downloading photographs from the Olympus camera

After returning from a field day, the photographs from the camera should be downloaded before going back into the field. Follow these steps for downloading photographs:

- Attach the Olympus camera download cable to a USB port on the computer and then attach the camera to the other end of the download cable.
- When the camera is attached to the download cable, it will automatically come on and reveal a list of four choices on the camera screen. These choices are PC, Easy Print, Custom Print, and Exit. At the right of the PC box there will be a right facing arrow. To activate this arrow, hit the lightning bolt key on the camera menu. This will take you to a new screen on the camera with two choices – Storage, and MTP. Hit the down button on the camera (of the camera menu buttons, it will show a clock on the button) to highlight the MTP choice.
- Press the OK button on the camera. On the computer screen this will bring up the Scanner and Camera Wizard (Figure SOP D-1). Click Next. This will take you to a new screen on the computer where you can choose pictures to copy. Pictures with a green arrow in the upper right hand corner will be the pictures that will be copied (Figure SOP D-2). Click Next.
- A new screen will appear on the computer. This will be the Picture Name and Destination page (Figure SOP D-3). In "Type a name for this group of pictures", follow this naming convention; Year_Project Name_Park. For example, in 2011 the Corridors of Invasiveness project was done in Biscayne National Park (BISC). Therefore, the group of pictures would have the label 2011_Corridors_BISC. Then choose a place for the group of pictures to be saved. Since the project was done in BISC in 2011, a folder was made (BISC_2011) in the images section of the Invasive exotic plants Vital Sign to store the photos for that year. When choosing a place to save the group of pictures, you would choose the following destination: Z:\SFCN\Vital_Signs\Invasive_exotic_plants\images\BISC_2011 (Figure SOP D-3). Within

the BISC_2011 folder make separate subfolders for each day trip. Name these subfolders with the date the fieldwork took place and then a site name within the park. For example, if you were working on Elliott Key on April 27, 2011, the subfolder would be named 20110427_Elliott_Key. This will keep the pictures in order by date and place visited.

- It is recommended that you delete the pictures from the camera after copying them. This can be done by clicking the box next to "Delete pictures from my device after copying them" (Figure SOP D-3). Click Next.
- The pictures will then be copied to the specified destination. A new screen on the computer will appear with other options (Figure SOP D-4). At this point you are finished downloading the pictures. Make sure the "Nothing. I'm finished working with these pictures" is checked and then hit Next (Figure SOP D-4). The pictures will then be copied. Click Finish. You can now disconnect the camera from the computer and put away the download cable and camera.

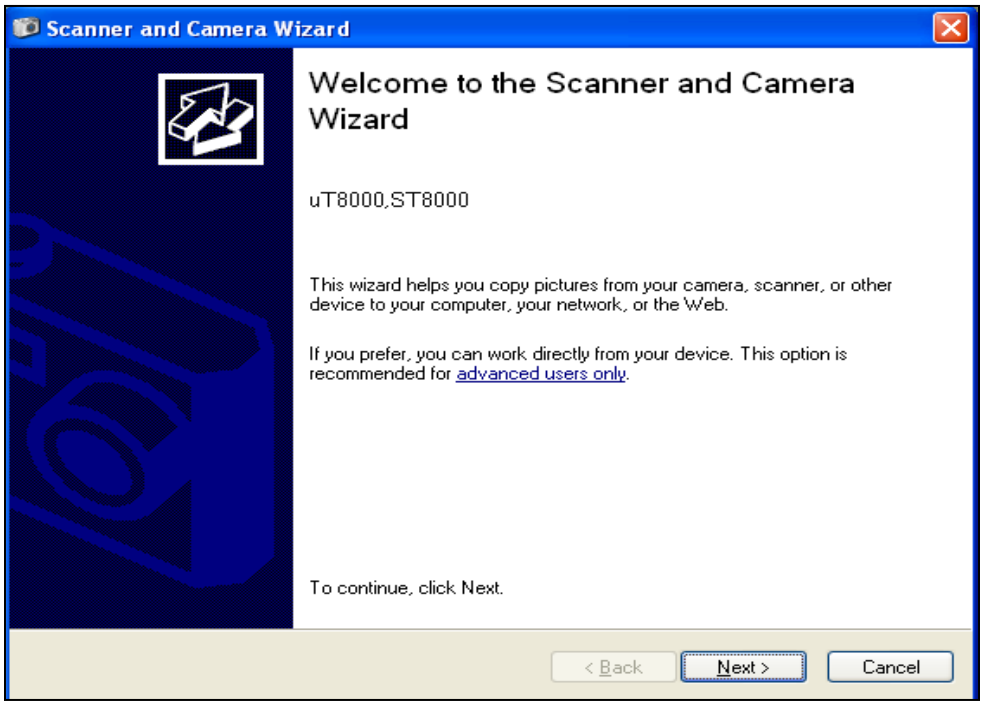


Figure SOP D-1.The Scanner and Camera Wizard will appear on the computer screen after highlighting and activating the MTP feature on the camera.

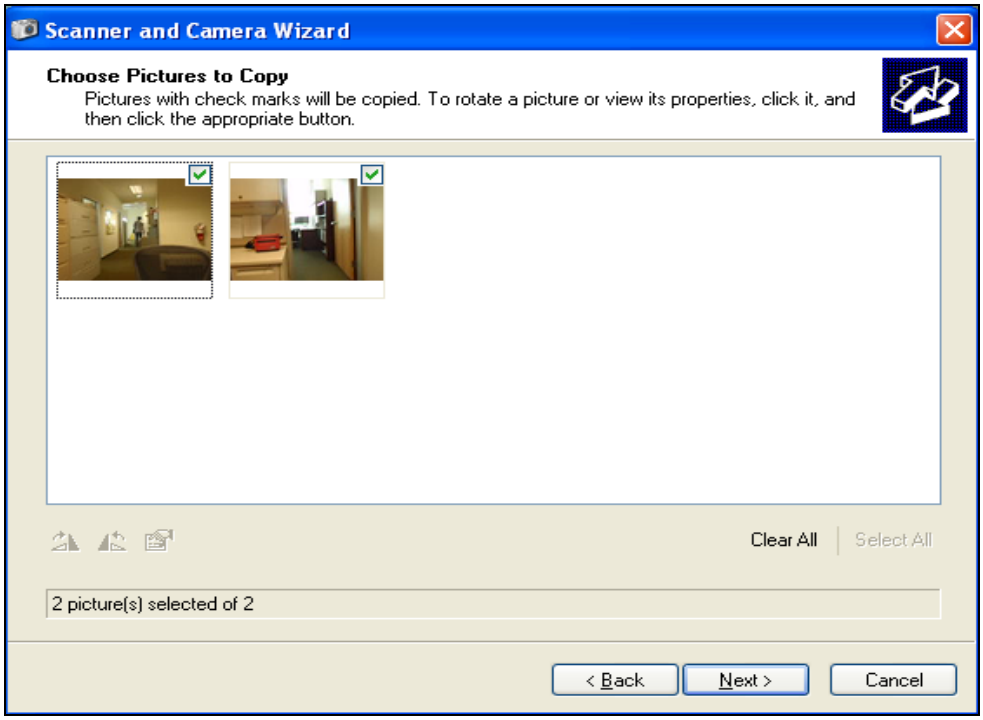


Figure SOP D-2. When clicking Next on the Scanner and Camera Wizard, this new screen appears to allow pictures to be copied. Pictures with check marks will be copied.

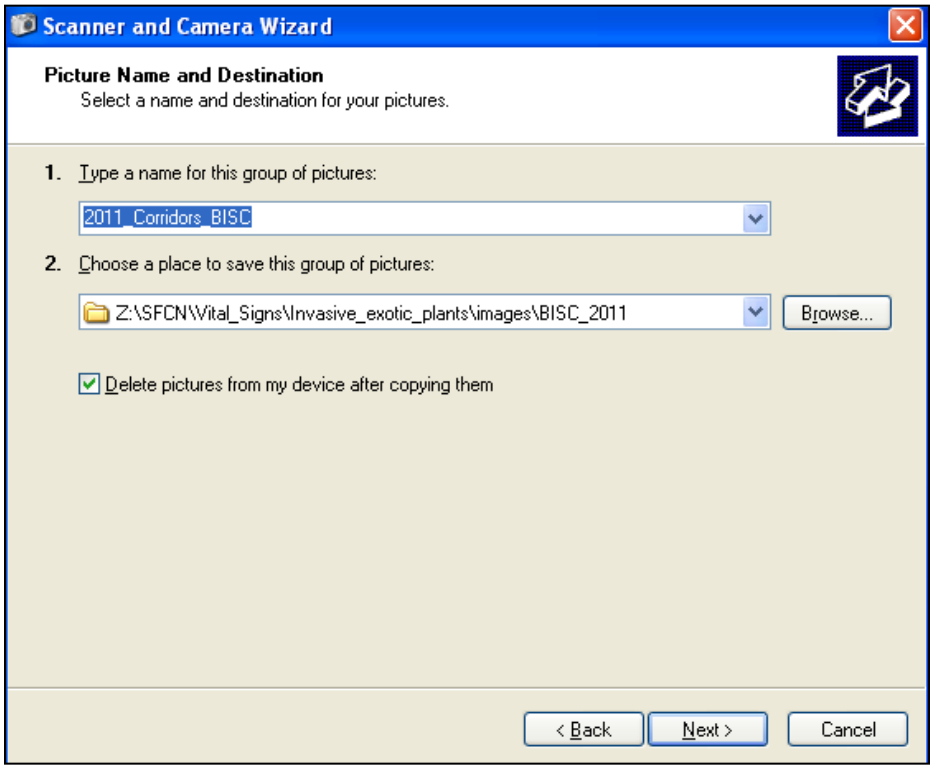


Figure SOP D-3. Name the group of pictures and assign a place to save the group of pictures on the Picture Name and Destination page.

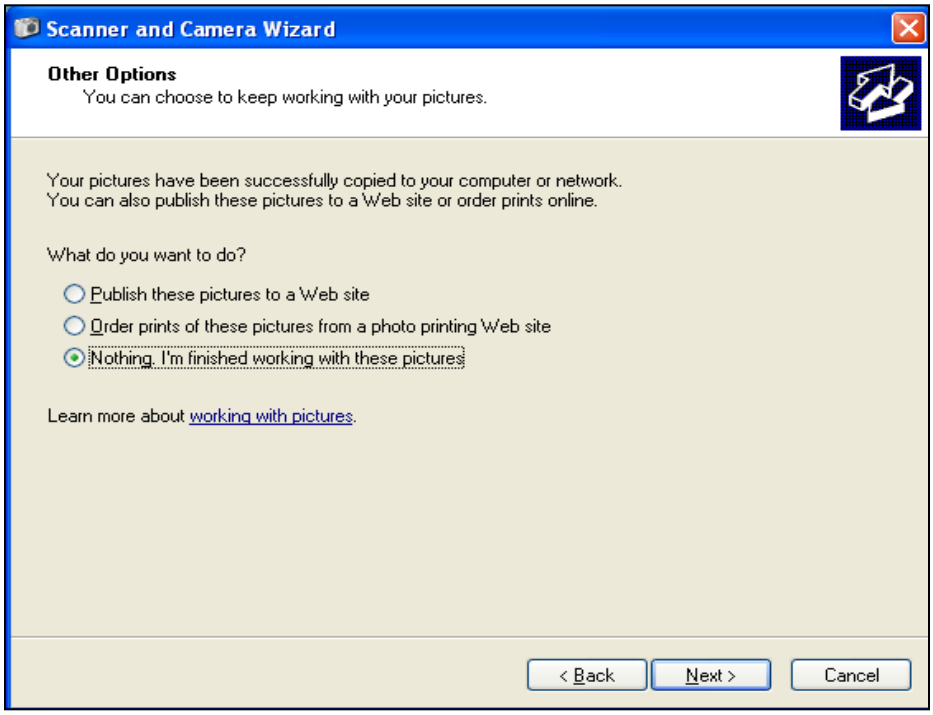


Figure SOP D-4. After pictures are copied the Other Options page appears. At this point you are finished downloading the pictures. Highlight the “Nothing I’m finished working with these pictures” and then click Next.

Entering photos via ThumbsPlus into MS Access Database

All photos are entered into Access database using ThumbsPlus. To access database with the ThumbsPlus software, navigate on the server to the Invasive Exotic Plant Access database at Z:\SFCN\Vital_Signs\Invasive_exotic_plants\data. Highlight and then right click the InvasiveExoticMonitoring.mdb Access database. Scroll down to the Open With selection, and then choose ThumbsPlus 7.0 (Figure SOP D-5). The ThumbsPlus database will then open up. Navigate to the images folder under the Invasive_exotic_plants Vital Sign to choose the folder of images you wish to work on (Figure SOP D-6).

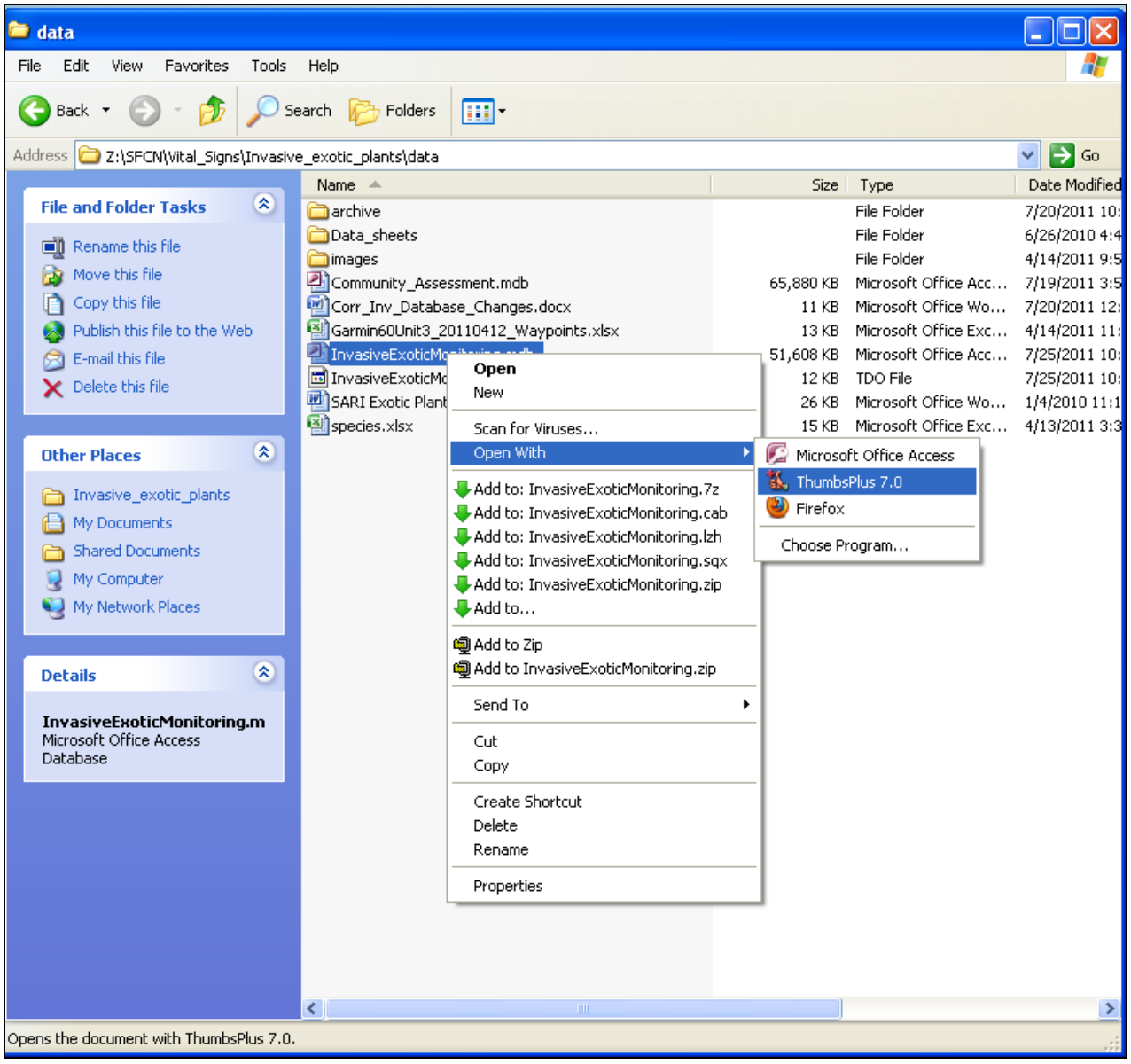


Figure SOP D-5. To open ThumbsPlus, first navigate to the InvasiveExoticMonitoring.mdb database and open with ThumbsPlus 7.0.

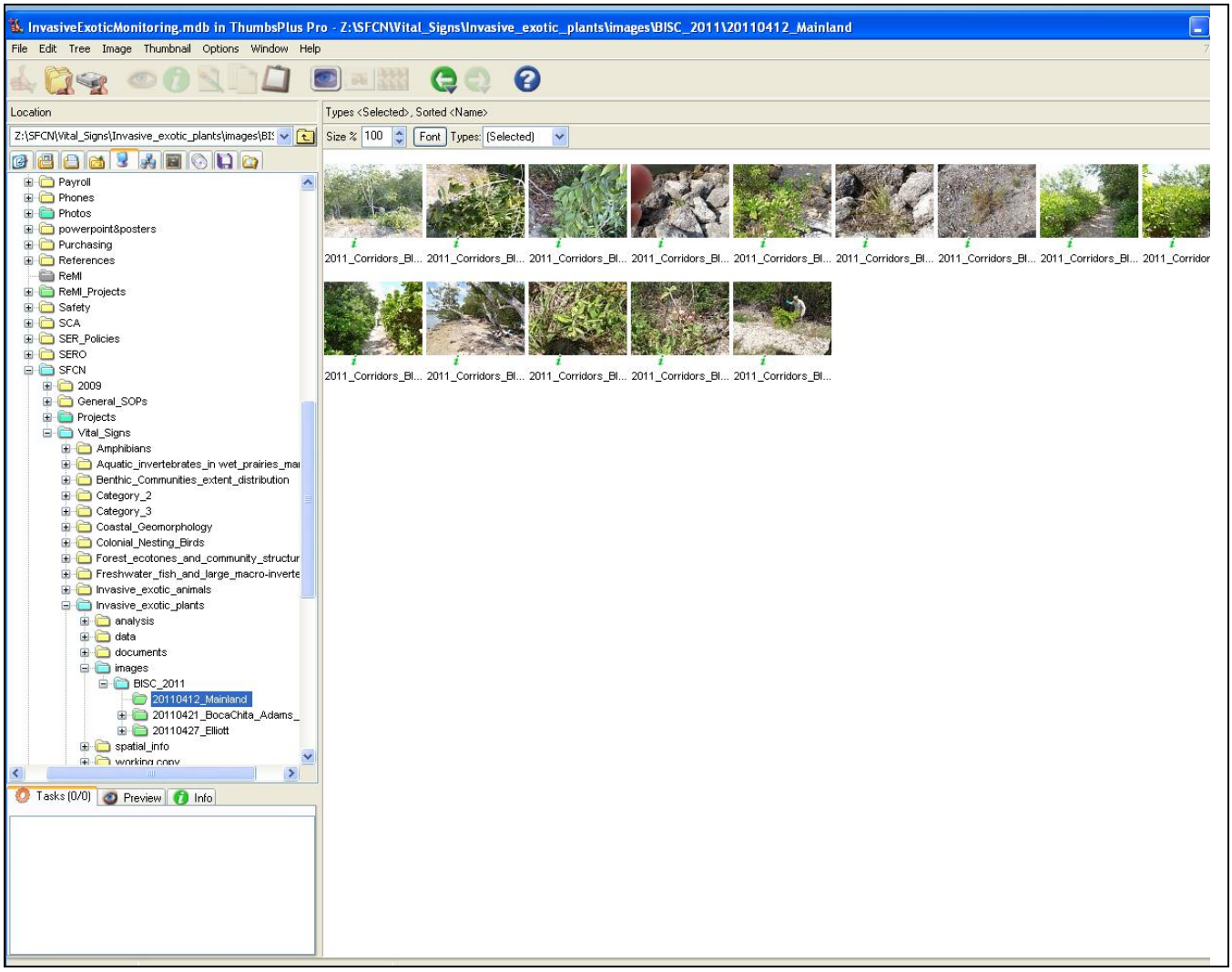


Figure SOP D-6. Once in ThumbsPlus, navigate to the images folder under the Invasive_exotic_plants Vital Sign to choose the folder of images you wish to work on.

After opening the desired images folder, the photographs are now ready to be tagged to the Access database. Single click on a photograph, hold down the Control (Ctrl) key on the keyboard and then press the U key. This will bring up the User Fields tab on the File Properties data field (Figure SOP D-7). Instructions for filling out the User Fields are as follows:

- **Original Date/Time** – This field is filled in on all the photos during the camera download process. Nothing further is required for this field.
- **Field_Date** – Enter the date that the data was collected in the field. Enter the date in the m(m)/d(d)/yyyy format. For example, January, 1 2012 would be entered as 1/1/2012.
- **Park** – Enter the four letter acronym for the National Park in which the field work occurred. The acronyms for the three parks included in this Vital Sign are BICY (Big Cypress National Preserve), BISC (Biscayne National Park, and EVER (Everglades National Park).
- **Project** – Enter "Corridors of Invasiveness" for this project.

- **GPS_Mark** – Enter the mark number from the GPS unit which corresponds to the photograph.
- **GPS_Unit** – Enter the number given to the GPS unit that was used in gathering field marks. Each of the handheld GPS units owned by SFCN has been given a number, which is written in multiple places with a sharpie on the unit itself. Sometimes, however, the number will get rubbed off the outer casing of the GPS unit. When this happens just open the cover to the battery storage area of the GPS unit, and the unit number will also be written there as well.
- **Site** – Enter the site within a National Park where the survey occurred. For example, if the survey took place in the Flamingo campground area of Everglades National Park, then Flamingo campground would be entered in this data field.
- **Species** – Enter the scientific name of the plant species depicted by the photograph.
- **Notes** – Enter any field notes or helpful hints associated with the photograph.
- **Unique_ID** – ThumbsPlus fills in this field automatically to represent the date, park, and mark number where the picture was taken.

Be sure to check the box by each user field when using the dropdown menus to fill in the data fields. *If the boxes are not checked then the data will not be saved.* Also, when all the fields are entered for a photograph, *click the Save button* to save the information for that photograph.

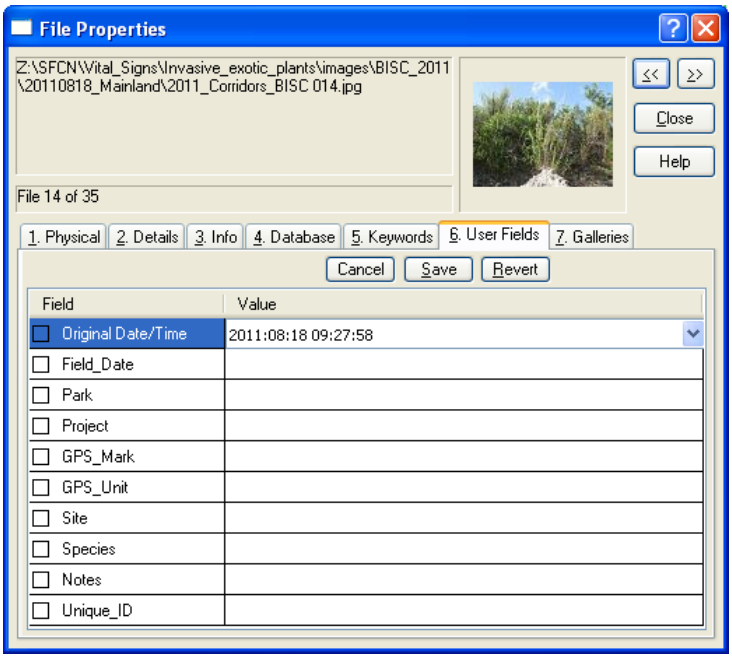


Figure SOP D-7. Example of the ThumbsPlus data entry page.

Entering Field Datasheets into Access Database

Data from completed field data sheets should be entered into the Access Database (Z:\SFCN\Vital_Signs\Invasive_exotic_plants\data\InvasiveExoticMonitoring.mdb) as soon as possible after returning from the field, while details from the field are still fresh on the mind of the researchers.

The Corridors of Invasiveness database is located in Z:\SFCN\Vital_Signs\Invasive_exotic_plants\data\InvasiveExoticMonitoring.mdb. The Access database (Figure SOP D-8) is designed to resemble the field data sheet (Appendix B) for ease in entering the data. The components of the Access database are as follows:

- **Date** – Enter the date that the fieldwork was completed. There is a calendar icon located to the right of the date entry box. By clicking on this box a calendar will appear with the current date highlighted. Just click on the date that fieldwork occurred and that date appears in the Date entry box.
- **GPS Unit #** – Enter the number given to the GPS unit that was used in gathering field marks. Each of the handheld GPS units owned by SFCN has been given a number, which is written in multiple places with a sharpie on the unit itself. Sometimes, however, the number will get rubbed off the outer casing of the GPS unit. When this happens just open the cover to the battery storage area of the GPS unit, and the unit number will also be written there as well.
- **Starting GPS Mark** – This is the mark taken at the beginning of a survey to denote the starting point of the survey. This mark is important in determining distance travelled during that particular survey, as well as having a beginning mark to illustrate on field report maps.
- **Ending GPS Mark** – This mark is taken at the end of the survey. This mark is important in determining distance travelled during that particular survey, as well as having an ending mark to illustrate on field report maps.
- **Park** – Enter the four letter code name for the National Park in which the survey occurred. There is a dropdown menu for this entry, and by clicking on the down arrow to the right of the entry field, the three National Parks appear. Click on the National Park that applies to this particular survey, and that Park appears in the Park entry box.
- **Site** – Enter the site within a National Park where the survey occurred. For example, if the survey took place in the Flamingo campground area of Everglades National Park, then Flamingo campground would be entered in this data field.
- **Observers** – Enter the initials of the individuals that took part in the survey. There is a dropdown menu located at the upper right of this data field, and by clicking on it a list of the names of people who were on past surveys appear. Click on the name or initials appearing in the dropdown menu and they appear in the date entry field.
- **Comments** – Enter any comments, remarks, or notes taken in the field. This may include site descriptions, observations, or any item of interest pertaining to the survey area.
- **Survey Type** – Enter the type of survey method used. There is a dropdown menu to the right of the data field box. By clicking it, a list of the survey methods appears. Click on the method that describes the survey type. Sometimes, when doing a driving survey, it is required to get

out of the vehicle and finish the survey by walking. In this case the Driving/Walking survey type is chosen.

- **Species** – Enter the six letter species code of the exotic species encountered during the survey. The six letter code consists of the first three letters of the genus and the first three letters of the specific epithet to come up with the species code. For example, *Schinus terebinthifolius* (Brazilian pepper), would have a species code of SCHTER. When a species code is entered in this data field, a new Species line will appear below the line where the data is being entered, in anticipation of the next exotic species. If the species you enter is not in the database, it will ask you if you are sure the spelling is correct and if you want to add the species to the database.
- **GPS Mark** – Enter the GPS mark that corresponds to the exotic species encountered.
- **Infested Area** – Enter the estimated size of the infestation as Length (m) and Width (m).
- **Abundance** – Enter the appropriate category number:
    - **1= 1 individual**
    - **2= 2-5 individuals**
    - **3= 6-10 individuals**
    - **4= 11-15 individuals**
    - **5= >15**
- **Comments** – Comments such as specific abundance or field of view estimates.
- **Treated** – Check this box if the exotic plant encountered was treated (sprayed with garlon, sprayed with glyphosate, or pulled out of the ground) in the field.
- **Treated With** – If the species encountered was not treated in the field, then leave this data field empty. Otherwise, enter whether the exotic was treated with garlon, glyphosate, pulled out, or any other means of eradication.
- **Habitat** – Enter the habitat in which the infestation is taking place.
- **Field of View Estimate** – Enter the estimated field of view from the road or trail. Circle the direction and enter the field of view estimate in meters in both directions to either side of the road or trail. This is the distance in meters one feels one can confidently view without too much obstruction for the purpose of sighting exotics in all three canopy layers (herb, shrub, tree).
- **Pictures** – Enter the number of pictures taken that corresponds to the exotic species encountered.

The following fields are not on the datasheet:

- **New Spp** – Check this box if the plant species found is new to the park being surveyed. (Note this is not on the datasheet but is determined subsequent to field work)
- **Native**– Check this box if the species entered is a native to the area surveyed. (Note this is not on the datasheet but is determined subsequent to field work)

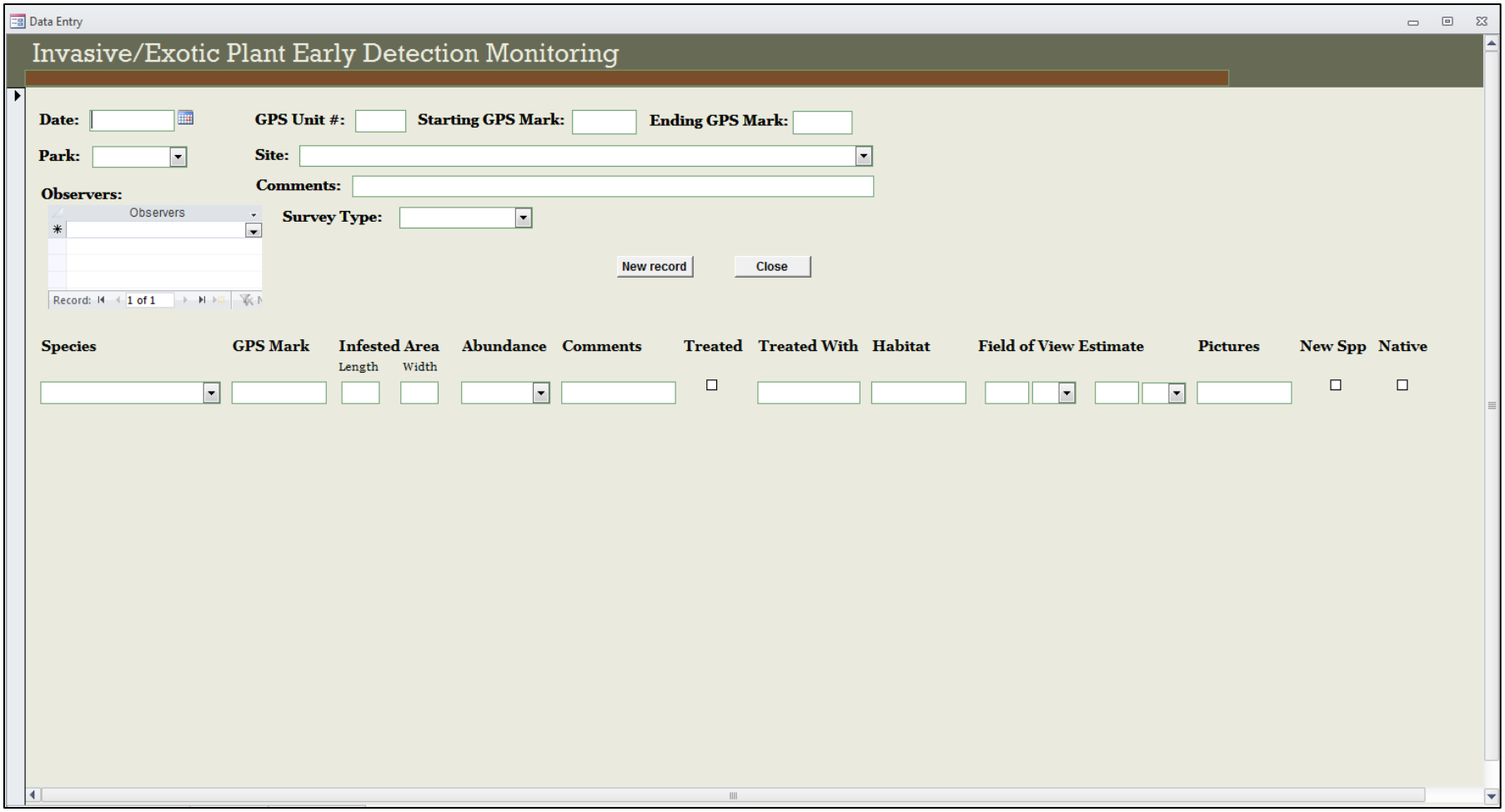


Figure SOP D-8. Example of the Access Database data entry page.

Standard Operating Procedure E – Uploading and Downloading GPS, and Appending Waypoints and Tracklines

(Version 1.0)

Version #	Date	Revised by	Changes	Justification

Purpose

Describe upload and download procedures for the GPS unit and procedures on appending the data to the database. A full power point presentation regarding the uploading and downloading of files can be found on the server at Z:\SFCN\General_SOPs/GPS_DNR_GarminLoading.pptx.

Procedures

GPS Waypoints and Tracklines

GPS waypoints and tracklines should be stored on the server in both

Z:\SFCN\Vital_Signs\Invasive_exotic_plants\spatial_info and Z:\GIS\GPS

Waypoints and tracklines should also be stored under the appropriate Park folders and sampling year, for example:

Z:\SFCN\Vital_Signs\Invasive_exotic_plants\spatial_info\BISC\2011_Surveys

Points and tracklines should be named with the following format:

YearMonthDay_SurveyArea_waypoints (tracklines).

For example: 20110420_ConvoyPt_Tracklines.shp and 20110420_ConvoyPt_Waypoints.shp

Use the following charts for directions on how to upload shapefiles to a GPS unit, download waypoints from a GPS unit to a computer shapefile, and download tracks from a GPS unit to a computer shapefile. Append the new waypoint and trackline files to the database using the instructions in the Append Waypoints and Append Tracklines section.

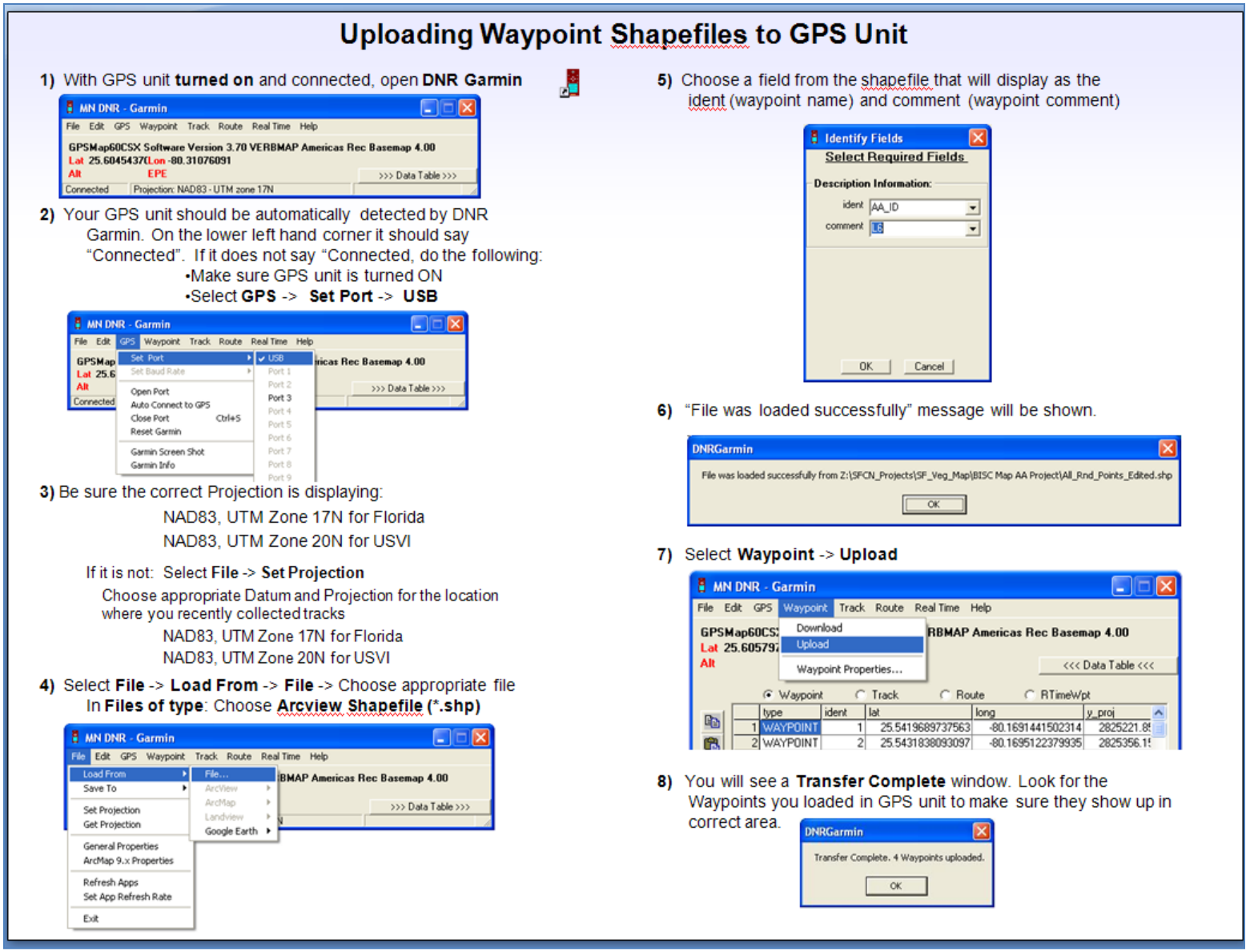
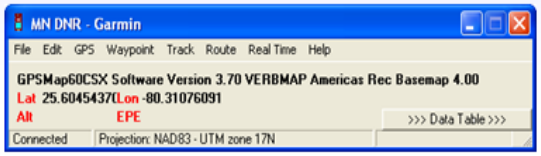


Figure SOP E-1. Step by step process for uploading waypoint shapefiles from the computer to the GPS unit.

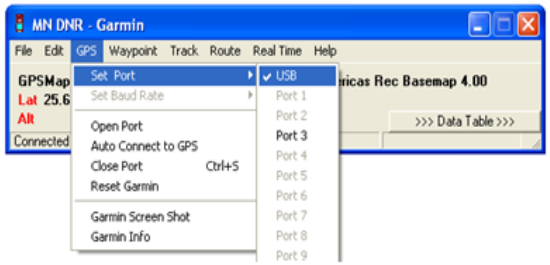
Downloading Waypoints from GPS Unit to Computer/Creating Shapefile

1) With GPS unit **turned on** and connected, open **DNR Garmin**



2) Your GPS unit should be automatically detected by DNR Garmin. On the lower left hand corner it should say "Connected". If it does not say "Connected, do the following:

- Make sure GPS unit is turned ON
- Select **GPS** -> **Set Port** -> **USB**



3) Be sure the correct Projection is displaying:

NAD83, UTM Zone 17N for Florida

NAD83, UTM Zone 20N for USVI

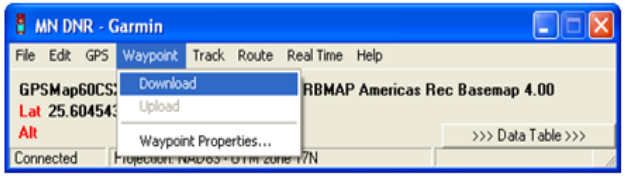
If it is not: Select **File** -> **Set Projection**

Choose appropriate Datum and Projection for the location where you recently collected points

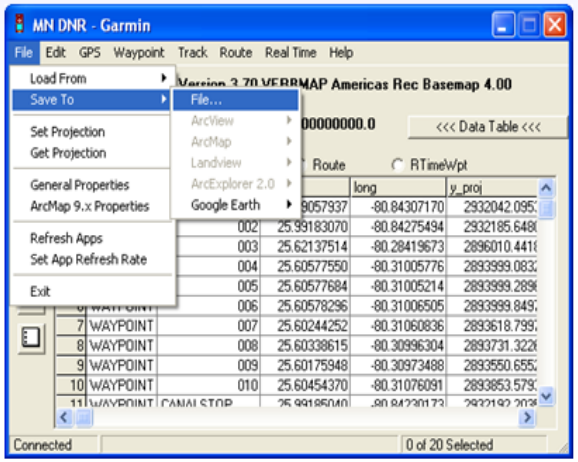
NAD83, UTM Zone 17N for Florida

NAD83, UTM Zone 20N for USVI

4) Select **Waypoint** -> **Download**



5) Select **File** -> **Save To** -> **File** ->



6) Save the file under *Z:\GIS\GPS* Select Folder of your GPS Unit (*Garmin 60CSx*) -> Choose Correct GPS Unit number (*1-5*) -> Save/Name as others in folder with correct date.

Also make sure the file name has no spaces, underscores are o.k.:
e.g. Garmin60Unit1_200908010_Waypoints.shp

In **Save as type**: Choose **Arcview Shapefile (Projected)(*.shp)**. **Save.**

Note: **After** saving to the GPS folder you can save this file to your current project **spatial** folder as well where you can modify and work with the file .

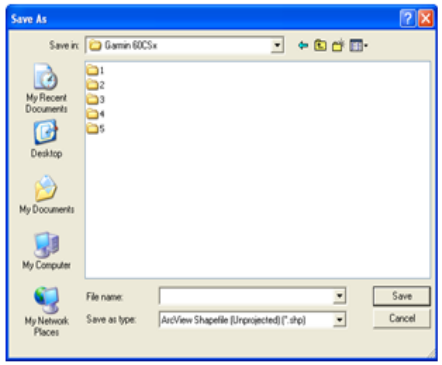
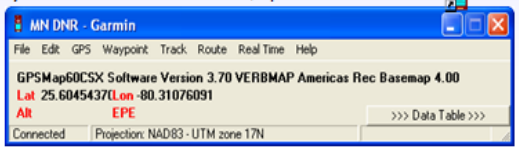


Figure SOP E-2. Step by step process for downloading field collected waypoints from the GPS unit to the computer and creating a shapefile.

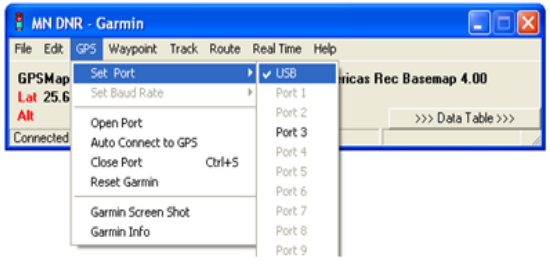
Downloading Tracks from GPS Unit to Computer/Creating Shapefile

1) With GPS unit connected, open **DNR Garmin**



2) Your GPS unit should be automatically detected by DNR Garmin. On the lower left hand corner it should say "Connected". If it does not say "Connected, do the following:

- Make sure GPS unit is turned ON
- Select **GPS** -> **Set Port** -> **USB**



3) Be sure the correct Projection is displaying:

NAD83, UTM Zone 17N for Florida

NAD83, UTM Zone 20N for USVI

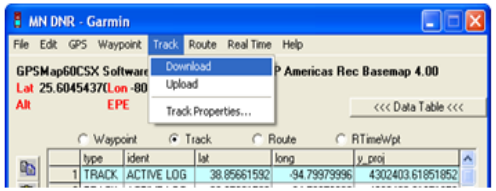
If it is not: Select **File** -> **Set Projection**

Choose appropriate Datum and Projection for the location where you recently collected tracks

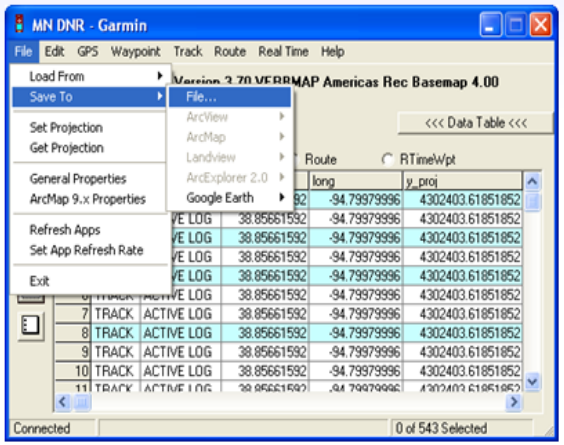
NAD83, UTM Zone 17N for Florida

NAD83, UTM Zone 20N for USVI

4) Select **Track** -> **Download**



5) Select **File** -> **Save To** -> **File**



6) Find Folder you want to save in, usually: Z:\GIS\GPS\into relevant folder and name file appropriately, as others in the folder. Also make sure the file name has no spaces, underscores are o.k.
e.g. Garmin60Unit1_20090810_Tracklines.shp
In **Save as type**: Choose **Arcview Shapefile (Projected)(*.shp)**.
Save. *Continued on next slide…*

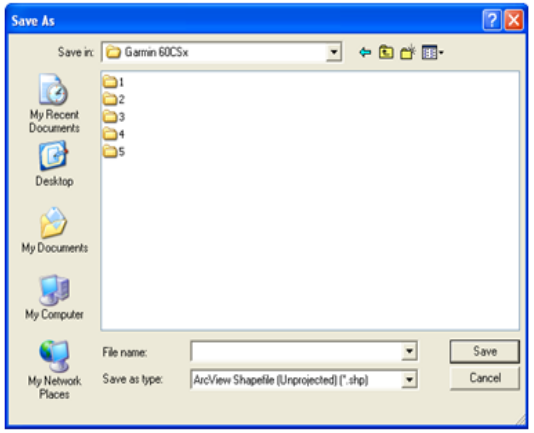
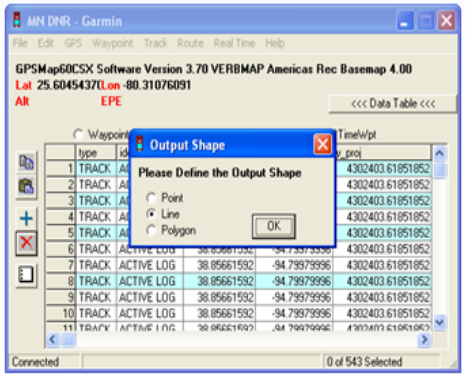


Figure SOP E-3. Step by step process for downloading field collected tracklines from the GPS unit to the computer and creating a shapefile.

Downloading Tracks from GPS Unit to Computer/Creating Shapefile

7) When saving **Tracks** an **Output Shape** Window appears after you click **Save**.



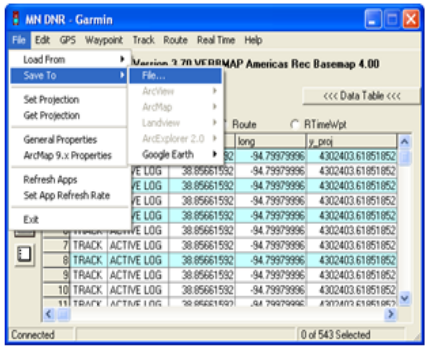
Choose **Line** option and then **OK**. If you also want to save the track points see *Downloading GPX file* on right.

Downloading GPX file (Track Points)

It's important to also save the Track Points as a GPX file. This file allows us to GeoTag the track point coordinates to photographs.

To do so:
After having completed previous Steps 1-4 during the Save process:

1) Select **File → Save To → File**



2) Find Folder you want to save in, usually: Z:\GIS\GPS\Garmin_60CSx into relevant folder and look for a **GPX** folder. Use the date you are downloading this file as the file's name: e.g. If today is May 15, 2010 name it 20100515

In **Save as type**: Choose **GPS eXchange Format (*.gpx)** → Save.

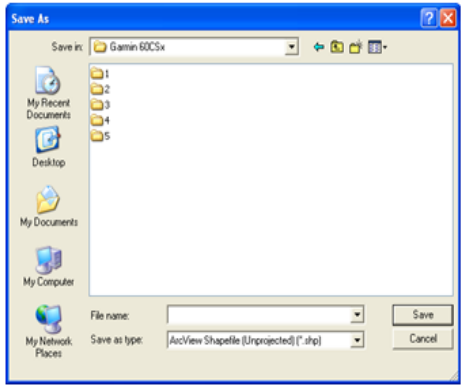


Figure SOP E-4. Continuation of step by step process from Figure SOP E-3.

After waypoints and tracklines are downloaded, they will then need to be appended for import into the Access database. To append waypoints and tracklines, use the following steps.

Appending Waypoints

Getting started

1. Once you saved your waypoint file to your folder, open up a new **ArcMap** project. *(This is assuming ArcGIS 10 is being used.)*
2. Add the shapefile you just created using the *Add Data* button.
3. The remaining steps require you to delete the waypoints that do not belong in this shapefile, i.e. waypoints from previous field visits that have already been appended to the ***Waypoints*** shapefile. Start editing the shapefile by going to *Editor* → *Start editing.*
4. Right click on the shapefile → Select *Open Attribute table.*
5. Sort the Table by *Comment* (which is the date waypoint was collected) by double-clicking the field.
6. There are two ways to delete the unwanted records. 1) Highlight the records you want to delete. Right click on the far left side of any one of the records and select *Delete Selected*. 2) If you have a lot of records to delete, it may be easier to highlight the waypoints you want to keep and then switch the selection so that the records you want to delete are selected. To do this highlight the waypoints that you want to keep. At the top of the attribute table click on the *Switch Selection* button. This will invert your current selection and highlight all the points you want to delete. Right click on the left side any one of the records and select *Delete Selected*.
7. Go back to *Editor*, select *Save Edits* and then select *Stop Editing*.

Adding three new fields

1. Open the attribute table if you closed it. Make sure you have Stopped Editing or you will not be able to add a new field.
2. At the top of the attribute table click on the *Table Options* button and select *Add Field*.
3. In *Name* type in **Park** and in *Type* select ***Text***. In the *Field Properties* box the length defaults to 50. Click in the box and type in **4**. Click *OK*. The field will show up at the far right of the attribute table.
   NOTE: It is important to type in the *Name*, *Type*, and *Length* of all new fields exactly as shown in this SOP or the shapefile may not append properly.
4. Add second new field (See Step 2 above).
5. In *Name* type in **Field_Date** and in *Type* select ***Text***. In the *Field Properties* box the length defaults to 50. Click in the box and type in **8**. Click *OK*.
6. Add third new field (See Step 2 above).
7. In *Name* type in **Unique_ID** and in *Type* select ***Text***. In the *Field Properties* box leave the default length set to 50. Click *OK*.

Filling in new and existing fields

1. With the attribute table open, right click on the **Park** field name, and select *Field Calculator*.
2. Type in the park acronym with quotes, e.g. "BISC" and click *OK*. All records should update with the park acronym you typed in.
3. Right click on the **Field_Date** field name, and select *Field Calculator*.
4. Type in the field date with quotes in a "yyyymmdd" format, e.g.: "20110723" and click *OK*. All records should update with the date you typed in.
5. Right click on the **Unique_ID** field name, and select *Field Calculator*.
6. Copy and Paste the following code into the *Field Calculator*: [Park]&""& [Field_Date]&"_"& [IDENT] NOTE- Make sure there are no spaces before or after the brackets, click *OK*. This will generate the unique ID for all records by concatenating the park code, the field date, and the GPS waypoint number.
7. Now add the Site Name in the field called **FILENAME**. Right click on the **FILENAME** field name, and select *Field Calculator*. Type in the site name, e.g. "Convoy Point".

Appending to Waypoints shapefile in geodatabase

1. We need to append your new waypoints shapefile to the existing ***Waypoints*** shapefile in the geodatabase. To do this, we first need to make a copy of your current waypoints shapefile in the geodatabase.
2. In **ArcCatalog**, look for the waypoints shapefile you want to bring into the geodatabase. Right click it and select *Export → To Geodatabase (single)*. A window will pop up called *Feature Class to Feature Class*. In the window under *Output Location* use the browse button to select the geodatabase you want to copy the shapefile into. In this case it is: *Z:\SFCN\Vital_Signs\Invasive_exotic_plants\data\InvasiveExoticMonitoring.mdb*
3. Under *Output Feature Class* type in the name of the shapefile you are copying in, but don't use numbers as the first character in the name, only letters. Click *OK*.
4. Once you have copied the shapefile into the database you can *Append*. With **ArcCatalog** open click on the **ArcToolbox** button. Click on *Data Management Tools → General → Append.*
5. In *Input Datasets* click and drag in the waypoints shapefile you just copied into the InvasiveExoticMonitoring.mdb database.
6. In *Target Dataset* click and drag in the file called ***Waypoints*** from the geodatabase.
7. In *Schema Type* click on the dropdown button and select *NO_TEST*.
8. Click on the *OK* button and the shapefile should append to the ***Waypoints*** shapefile. Normally, a pop-up window shows up that says "Append" and has a green check mark. This indicates that your *Append* has worked successfully. If you see the pop-up window and it shows a red X mark instead, the *Append* tool did not work correctly.
9. Open up an **ArcMap** project and add the ***Waypoints*** shapefile to it. You can also add the World Imagery layer from ThemeManager. Open the attribute table of the ***Waypoints*** shapefile and look for your newly appended records. Once you make sure it appended

correctly, in **ArcCatalog,** you can right click on the shapefile you copied into the geodatabase and *Delete* it. You do not need it in the geodatabase.

Appending Tracklines

Getting started

1. Once you saved your trackline file to your folder, open up a new **ArcMap** project.
2. Add the shapefile you just created using the *Add Data* button.
3. Delete the tracklines that do not belong on this shapefile, i.e. tracklines from previous field visits that have already been appended to the ***Tracklines*** shapefile. Start editing the shapefile by going to *Editor* → *Start editing.*
4. Right click on the shapefile → Select *Open Attribute table.*
5. Sort the Table by *LTIME* (the date trackline recorded, local time) by double-clicking the field.
6. Select and Highlight the records you want to delete.
7. At the top of the attribute table click on the *Table Options* button.
8. Right click on the left side of any one of the records and select *Delete Selected.*
9. Go back to *Editor*, select *save Edits* and then select *Stop Editing*.

Adding three new fields

1. Open the attribute table if you closed it. Make sure you have Stopped Editing or you will not be able to add a new field.
2. Click on the *Options* button on the bottom and select *Add Field*.
3. In *Name* type in **SurveyType** and in *Type* select ***Text***. In the *Field Properties* box leave the default length set to 50. Click *OK*. The field will show up at the far right of the attribute table.
   NOTE: It is important to type in the *Name*, *Type,* and *Length* of all new fields exactly as shown in this SOP or the shapefile may not append properly.
4. Add second new field (See Step 2 above).
5. In *Name* type in **Length_km** and in *Type* select ***Float***. In the *Field Properties* box change the *Precision* number to **4** and the *Scale* number to **2**. Click *OK*.
6. Add third new field (See Step 2 above).
7. In *Name* type in **Park** and in *Type* select ***Text***. In the *Field Properties* box the length defaults to 50. Click in the box and type in **4**. Click *OK*. The field will show up at the far right of the attribute table.

Filling in new and existing fields

1. With the attribute table open start editing by going to *Editor* → *Start editing.*
2. Under **SurveyType** fill in the survey type for each record.
3. For **Length_km** field right click on the field name, and select *Calculate Geometry*.

4. Make sure in *Property* it says *Length*. Under *Coordinate System* it should say *PCS: NAD 1983 UTM Zone 17N*. In *Units* use the drop down arrow to select *kilometers [km]*. All records should update with the trackline's length in kilometers.
5. For the **Park** field right click on the field name, and select *Field Calculator*.
6. Type in the park acronym with quotes, e.g. "BISC" and click *OK*. All records should update with the park acronym you typed in.
7. Now add the Site Name in the field called **FILENAME**. Right click on the **FILENAME** field name, and select *Field Calculator*. Type in the site name, e.g. "Convoy Point".

Appending to Tracklines shapefile in geodatabase

1. We need to append your new trackline shapefile to the existing ***Tracklines*** shapefile in the database. To do this, we first need to make a copy of your current trackline shapefile in the geodatabase.
2. In **ArcCatalog**, look for the trackline shapefile you want to bring into the geodatabase. Right click it and select *Export → To Geodatabase (single)*. A window will pop up called *Feature Class to Feature Class*.
3. In the window under *Output Location* use the browse button to select the geodatabase you want to copy the shapefile into. In this case it is: *Z:\SFCN\Vital_Signs\Invasive_exotic_plants\data\InvasiveExoticMonitoring.mdb.*
4. Under *Output Feature Class* type in the name of the shapefile you are copying in, but don't use numbers as the first character in the name, only letters. Click *OK*. Once you have copied the shapefile into the database you can *Append*.
5. With **ArcCatalog** open click on the *ArcToolbox* button. Click on *Data Management Tools → General → Append.*
6. In *Input Datasets* click and drag in the trackline shapefile you just copied into the InvasiveExoticMonitoring.mdb database.
7. In *Target Dataset* click and drag in the file called ***Tracklines*** from the geodatabase.
8. In *Schema Type* click on the dropdown button and select *NO_TEST*.
9. Click on the *OK* button and the shapefile should append to the shapefile. Normally a little pop-up window shows up that says "Append" and has a green check mark. This indicates that your *Append* has worked successfully. If you see the pop-up window and it shows a red X mark instead, the *Append* tool did not work correctly.
10. Open up an **ArcMap** project and add the ***Tracklines*** shapefile to it. You can also add the World Imagery layer from ThemeManager. Open the attribute table of the ***Tracklines*** shapefile and look for your newly appended records. Once you make sure it appended correctly, in **ArcCatalog,** you can right click on the shapefile you copied into the geodatabase and *Delete* it. You do not need it in the geodatabase.

Standard Operating Procedure F – Analysis

(Version 1.0)

Version #	Date	Revised by	Changes	Justification

Purpose

Describes procedures for digitizing tracklines in ArcGIS, creating buffered field of view estimates, mapping infestation data points buffered by area of infestation, and correcting large infestations so they display appropriately and are calculated correctly in the analysis of percent infested area.

- In ArcGIS, the tracklines and waypoints are displayed together with aerial imagery.
- The corridors monitored are digitized using the GPS tracklines shapefile as a guide to create a new line shapefile running down the center of the road, trail, etc. surveyed.
- The digitized line is buffered based upon the "Field of View" estimate.
- The waypoints themselves are buffered by the size of the area of the infestation present to create a new shapefile for the infested areas.
- The observer reviews the new infested areas shapefile.
  - As some infestation locations were estimated from the roadside, locations are reviewed together with aerial imagery. If necessary they are moved to match the aerial imagery.
  - If the infested area is greater than 1000 m^2, the observer reviews these areas and decides whether they need to be redrawn/digitized based on the aerial imagery.
  - In cases where the infestation is large and has areas both inside and outside the high confidence field of view corridor the polygon is split where the overlap with the high confidence field of view buffer occurs. This creates two polygons that remain linked to the same waypoint with one polygon labeled as "inside" the field of view and the other "outside". Only the "inside" polygon will be used for percent infestation calculations. The original field estimate will remain unchanged.
- Percent infested area is calculated by taking the area of infestations ("inside" the buffer) and dividing by the total area surveyed (total digitized line buffered area). Calculations are made by species and across all species.

Procedures

Creating the Corridors Shapefile (Digitizing Tracklines)

(Do this only if this is the first time you have visited this area, or it is a revisit in which you need to add new tracks.)

The original tracklines shapefile is too complicated to work with, so you will have to digitize the lines instead by tracing over the original shapefile**.**

1. Open up a blank ArcMap project.

2. Add in your *Tracklines* shapefile from the database (InvasiveExoticMonitoring.mdb) and the *Tracklines_Digitized* shapefile, from the Working_Database.mdb database, by clicking on the *Add Data* button and selecting the shapefiles. Add the latest imagery to your map. You can use the World Imagery layer from ThemeManager or the latest aerial imagery for the area you are working in.

3. Start editing your *Tracklines_Digitized* shapefile by clicking *Editor* → *Start Editing*.

4. A new window will show up on the right side of the Map: Select the shapefile you want to edit in the top section. On the bottom section click on *Polyline* (you will be drawing a line).

5. Lines need to be specifically digitized as follows in order for step 6 to work later. If you are digitizing a trackline that runs vertically, digitize the line by starting at the very south end of the trail and make your way north. If the trail is horizontal, digitize the line by starting at the West of the trail and make your way East.

6. Zoom in to a scale of 1:1,000.To digitize: click along the top of the original *Tracklines* shapefile to draw your new line. Make your lines as smooth as possible. Don't digitize peaks or zig-zag lines. The purpose of digitizing is to have a clean trackline file to work with. Double-click to end the line. Next we need to split up the corridors based either on the start and end points (you will need to work with the *Waypoints* shapefile after it has been updated, see *Appending to Waypoints shapefile in geodatabase,* in unison with the database which contains start and end waypoint information). To split a line: Start editing the shapefile by clicking on *Editor → Start Editing.* Select the line you wish to split using the arrow in the *Editor* toolbar. Once selected, click on the *Split Tool*. Click in the line where you want to make a split, this will split the line. In the attribute table of your shapefile, fill in the corresponding *Field of View* data for the newly split lines. The *Field of View* data is determined by the waypoint corresponding to the line. Also, fill in the Field Date information and the Site Name. Do this for all the tracklines.

Creating a buffer based on the field of view estimate.

7. Now buffers need to be created. Select/Highlight all records that have something under the field FieldView_East. This field of view estimate should create a buffer to the right side of the corridor trackline. This is why it was important that you digitize your lines from South to North and from West to East, so that the East and South field of view estimate buffers always fall to the Right side of the lines. If you did not properly digitize in the directions that were specified, you may have your buffers switched, e.g. if West was 20m and East was 5m your buffer may have 5m West and 20m East. This is critical later on when you calculate how much of the infested areas you observed fall inside the field of view estimates.

8. Before you create the buffers, the older lines found in the shapefile need to be queried out so that you are only creating buffers for the new lines you created today. Right-click on the *Tracklines_Digitized* shapefile and select Properties. Under the tabs select Definition Query → Query Builder. Double-click on *Field_Date* (If you don't see it, scroll down the list until you find it).

9. Click on the greater than or equal to">=" sign. Then click on *Get Unique Values*. Double-click on the earliest field date for the park and region you are working in, i.e. if you went out in the field May 12th, June 12th, and July 12th, select May 12th as the field date. This will display all tracklines for dates equal to or after May 12th. Click *OK*.

10. Click on ArcToolbox, select *Analysis Tools* → *Proximity* → *Buffer*.

11. Drag and drop the *Tracklines_Digitized* shapefile into the *Input Features* section.

12. In *Output feature class* section call this shapefile CorridorBuffer*PARKRegionMonthYearCollectedFieldofViewEstimateDirection:*
    It should read:
    Z:\SFCN\Vital_Signs\Invasive_exotic_plants\data\Working_Database.mdb\CorridorBufferEVEREastJune2012East.
    If you have data for more than one month use the last month of field work for the file name.

13. Under the *Distance* section click on *Field*. Click on the drop down list and select the cardinal direction you are going to buffer, in this case East.

14. Under *Side Type* click the drop down and select Left or Right to indicate which side of your line the buffer will be drawn to. (If you digitize based on the specifications in previous steps for the East and South buffers you would select Right and for the West and North buffers you would select Left.)

15. On *End Type* click the drop down and select *Flat*.

16. Click *OK*.

17. Do the same for the West, North, and South records, replacing the cardinal direction in the filename as you go along.

Merging the 4 shapefiles to create one shapefile.

18. Open up arc toolbox, select *Data Management* → *General* → *Merge*

19. In *Input Datasets* click on the drop-down to select the 4 shapefiles you just created.

20. In *Output Dataset* click on the browse button and select your Working_Database.mdb database. Name the file CorridorBuffer*PARKRegionMonthYearCollected*All, e.g. CorridorBufferEVEREastJune2012All. Once you have created this merged file it will be appended to the master Corridors Field of View shapefile in the main database.

21. Add the file called *Corridors_FieldofView* from the InvasiveExoticMonitoring.mdb database to your ArcMap project.

22. Select ArcToolbox and click on *Data Management Tools* → *General* → *Append.*

23. In *Input Datasets* click and drag in the shapefile you just created (CorridorBufferEVEREastJune2012All).

24. In *Target Dataset* click and drag in the file called *Corridors_FieldofView* from the InvasiveExoticMonitoring.mdb database.

25. Click on the *OK* button and the shapefile should append to the *Corridors_FieldofView* shapefile. Normally, a pop-up window shows up that says "Append" and has a green check mark. This indicates that your *Append* has worked successfully. If you see the pop-up window and it shows a red X mark instead, the *Append* tool did not work correctly.

Creating the Infested Area Shapefile

1. Open up the InvasiveExoticMonitoring.mdb Microsoft Access database.

2. Click on the button under *Data* called *Export Waypoints*. Select the Park and Year you want to work with. A table should show up called: *tbl_WaypointsExport*. Close the table and close the access database.

3. Open up an ArcMap project. Use the *Add Data* button to add the table just created: "tbl_WaypointsExport". You can also add the World imagery from ThemeManager or other latest imagery.

4. Now this table has to be converted to a temporary shapefile. The table will display in ArcMap on the Table of Contents (box on the left screen.) Right-click on the table itself and select *Display XY Data.*

5. In the X Field box use the drop down and select *X_PROJ*. In the Y Field box use the drop down and select *Y_PROJ*. If the Projected Coordinate System does not read: "Name: NAD_1983_UTM_Zone_17N" and Geographic Coordinate System read: "Name: GCS_North_American_1983" then → Click on the *Edit* button. Click on *Select→Projected Coordinate Systems → UTM → NAD 1983 → NAD 1983 UTM Zone 17N.prj*. Now click *OK* and then click *OK* again. The temporary shapefile will display and it is called "tbl_WaypointsExport Events".

6. To make this temporary shapefile permanent: Right-click on the shapefile and select *Data → Export Data*. When the "*Export Data*" box opens up click on the *Browse* button to select the location you want to save it to. Browse to your Working_Database.mdb database found in: Z:\SFCN\Vital_Signs\Invasive_exotic_plants\data\Working_Database.mdb
and name your shapefile "WaypointsExportPARKYYYYMMDD" Date should be the date you created the shapefile, e.g. WaypointsExportEVER20120822.

Creating the Infested Area size polygons

7. Open up arc toolbox, select *Analysis Tools → Proximity → Buffer*

8. Drag and drop the *WaypointsExportEVER20120822* shapefile into the *Input Features* section.

9. In *Output feature Class* call this shapefile InfestedAreaBuffer*PARKRegionMonthYearCOLLECTED : example:* InfestedAreaBufferEVEREastJune2012. If you have data for more than one month use the last month of field work for the file name.

10. Under the *Distance* section click on *Field*. Click on the drop down list and select *Radius*.

11. Click *OK*. This tool will create the infested area polygons. Now we will need to move them to their actual location based on the imagery or digitize large areas based on imagery.

Moving Infested Area Polygons to Correct Location

1. Start Editing. Click on the *Editor* button→ *Start Editing*. Select the shapefile you are going to edit, example: *InfestedAreaBufferEVEREastJune2012* that you just created in previous steps. Click *OK*.

2. Right-click on your shapefile and select *Open Attribute Table*. Right click on each record and zoom to your polygons one by one and decide whether it needs to be moved to a different location. If it needs to be moved, Select/Highlight it using the *Editor* Tool Bar Select Arrow. Once it is selected, drag and drop it to its new location. If there are multiple polygons on top of each other, select them all at once and drag and drop them into their new location.

3. Save Edits. *Editor* → *Save Edits* → *Stop Editing*.

Digitizing a Large Area

1. Open up your Infested area polygon shapefile, i.e. *InfestedAreaBufferEVEREastJune2012*. Zoom to the areas where you have an Area greater than 1000 sq m.

   As you zoom into each infested area, decide whether
   a) The polygon needs to be redrawn. These areas are very big and probably need to be digitized/redrawn based on imagery.

   b) If the new polygon should encompass the entire corridor buffer shapefile, you can trace the corridor buffer to create your new polygon.

<u>If infested areas need to be re-drawn</u>

2. To start digitizing open up an ArcMap project and bring in your *InfestedAreaBufferEVEREastJune2012* shapefile. Click on *Editor* → *Start Editing* → Select the shapefile you will edit from the list, i.e. *InfestedAreaBufferEVEREastJune2012*.

3. A new window will show up on the right side of the Map: Select the shapefile you want to edit in the top window. On the bottom window Click on *Polygon* (you will be drawing a polygon).

4. If you are drawing a polygon based on aerial imagery, begin digitizing by clicking along the vegetation in the aerial imagery and double-click to close the polygon once you are done digitizing it. Now you need to transfer the data from the original polygon that you are replacing to the new polygon that you just drew.

5. Open up the attribute table of the shapefile you are editing. Right-click shapefile → *Open Attribute Table*. Select the original polygon record and the one you just digitized. You can first select one and while pressing down on the Ctrl key select the other so that both are highlighted. Open up the attribute table and click on the *Show selected records* button at the bottom of the table. This will display only the two polygons you selected. Now Copy and

Paste each cell from the original polygon record to the new polygon record. Keep in mind that some fields such as *OBJECTID, Shape*, *Shape_Length*, and *Shape_Area* are generated automatically; therefore you cannot copy and paste them. Once all data has been copied over, you can delete the original polygon. Delete by selecting the polygon you wish to delete and right-clicking and selecting *Delete*.

If polygon corresponds to buffer shape.

If the new polygon should encompass the entire corridor buffer shapefile, you can trace the corridor buffer to create your new polygon**.**

6. To do this: Start editing the Infested Area shapefile, i.e. *InfestedAreaBufferEVEREastJune2012*. Select/Highlight the corridor buffer you want to trace. On the window to the right make sure you have selected the correct shapefile to edit (*InfestedAreaBufferEVEREastJune2012*) and on the bottom window select *polygon*. Near the *Editor* Toolbar click on the *Trace* button. Now click on the edge of the selected polygon one time and then move your mouse around the entire polygon to trace it. When you finish tracing the polygon double-click to close the polygon.

7. Open up the attribute table of the shapefile you are editing. Right-click shapefile → *Open Attribute Table*. Select the original polygon record and the one you just digitized. You can first select one and while pressing down on the Ctrl key select the other so that both are highlighted. Open up the attribute table and click on the *Show selected records* button at the bottom of the table. This will display only the two polygons you selected. Now Copy and Paste each cell from the original polygon record to the new polygon record. Keep in mind that some fields such as *OBJECTID, Shape*, *Shape_Length*, and *Shape_Area* are generated automatically; therefore you cannot copy and paste them. Once all data has been copied over, you can delete the original polygon. Delete by selecting the polygon you wish to delete and right-clicking and selecting *Delete*. If there is no original shapefile and you are drawing the area based on field notes or on the waypoint comments, be sure you fill in all the fields you can for this record.

Splitting Infested Area Polygons Based Upon Areas Inside and Outside Corridors

In order to calculate how much of an infested area falls within the field of view estimate and how much of it falls outside we need to run two tools that will create two new shapefiles, and then merge these two together.

1. Open up an ArcMap project and Add your Infested Area layer (*InfestedAreaBufferEVEREastJune2012*) and your Corridor layer (*CorridorBufferEVEREastJune2012*).

Using the Clip tool to create a shapefile that includes the infested areas that fall inside the field of view estimate (corridors).

2. Open up arc toolbox, select *Analysis Tools* → *Extract* → *Clip*

3. In *Input Features* use the drop-down and select the *Infested Area* shapefile.

4. In *Clip Features* use the drop-down and select the *Corridors* shapefile.

5. In *Output Feature Class* click on the *browse* button and select your database Working_Database.mdb. Name the file InfestedAreaBufferInside and the date you created it, e.g. InfestedAreaBufferInside20120918. This will be deleted later.

6. Click *OK*.

7. Now you need to create a new field to specify whether these records fall inside our outside the field of view estimate. Open up the attribute table of your new shapefile. Click on the *Table Options* button and select *Add New Field*. Make it a Text and call it *InOut* and for its size type in 7.

8. Now right click on the top of the field and select *Field Calculator*. Type in quotes "Inside" and click *OK*.

<u>Using the Erase tool to create a shapefile that includes the infested areas that fall outside the field of view estimate (corridors).</u>

9. Now use the Erase tool to create a shapefile that includes the infested areas that fall outside of the field of view estimate (corridors).

10. Open up arc toolbox, select *Analysis Tools* → *Overlay* → *Erase*

11. In *Input Features* use the drop-down and select the *Infested Area* shapefile.

12. In *Erase Features* use the drop-down and select the *Corridors* shapefile.

13. In *Output Feature Class* click on the *browse* button and select your database. Name the file *InfestedAreaBufferOutside* and the date you created it, e.g. *InfestedAreaBufferOutside20120918.* This will be deleted later.

14. Click *OK*.

15. Open up the attribute table of your new shapefile. Click on the *Table Options* button and select *Add New Field*. Make it a Text and call it *InOut* and for its size type in 7.

16. Now right click on the top of the Field and select *Field Calculator*. Type in quotes "Outside" and click *OK*.

17. Now these two shapefiles need to be merged to create one shapefile.

18. Open up arc toolbox, select *Data Management* → *General* → *Merge*

19. In *Input Datasets* click on the drop-down to select the two shapefiles you just created.

20. In *Output Dataset* click on the browse button and select your Working_Database.mdb database. Name the file InfestedAreasParkYear, e.g. InfestedAreasEVER2012. Once you have created this merged file you can delete the *InfestedAreaBufferInside20120918* and the *InfestedAreaBufferOutside20120918* shapefiles from the database.

21. Add the file called *Infested_Areas* from the InvasiveExoticMonitoring.mdb database to your ArcMap project.

22. Now the file you just created (*InfestedAreaBufferInside20120918)* needs to be appended to the Infested Areas shapefile.

23. Select ArcToolbox and click on *Data Management Tools* → *General* → *Append.*

24. In *Input Datasets* click and drag in the shapefile you just created (*InfestedAreaBufferInside20120918).*

25. In *Target Dataset* click and drag in the file called *Infested_Areas* from the InvasiveExoticMonitoring.mdb database.

26. Click on the *OK* button and the shapefile should append to the *Corridors_FieldofView* shapefile. Normally, a pop-up window shows up that says "Append" and has a green check mark. This indicates that your *Append* has worked successfully. If you see the pop-up window and it shows a red X mark instead, the *Append* tool did not work correctly.

Standard Operating Procedure G – Reporting

(Version 1.0)

Version #	Date	Revised by	Changes	Justification

Purpose

Describes the process for creating report maps and tables, and sending information out to the parks and EDDMapS. Additionally, this also describes how to import and summarize data received from EDDMapS.

Procedure

Creating the Annual Summary Report

At the conclusion of sampling, an annual data summary report is created by filling in the data summary template in

Z:\SFCN\Vital_Signs\Invasive_exotic_plants\documents\protocol\Corr_Inv_Data_Summary_Template_NoCover.docx

Please save this file with a new name in a new folder for the park and year surveyed, e.g. Z:\SFCN\Vital_Signs\Invasive_exotic_plants\documents\summaries_reports\2012_Corridors_Summary_Report_EVER\YYYY_Summary_Report_PARK.

The template is designed to be rapidly generated by updating the areas in yellow and appending maps and tables to generate the report. "Methods" briefly describes any changes from the written protocol and lists the areas where it was implemented and if anything special occurred that year to disrupt surveys (e.g., hurricane, fires, severe drought). "Results" provides a brief summary of the most important findings (e.g., new species) and points the reader to the tables and maps for the complete data results. A printout is provided in Appendix D – Data Summary Report Template.

<u>Creating survey site maps for summary report</u>

There are currently two map templates for creating maps for the Data Summary Reports. These can be found in the root of the spatial_info folder found under Invasive_exotic_plants: Z:\SFCN\Vital_Signs\Invasive_exotic_plants\spatial_info. The templates include a portrait version and a landscape version. They are called Summary_Maps_Template_Portrait and Summary_Maps_Template_Landscape.

1. Open the map template that the park or section of the park you are working with will best fit in. The Waypoints and Tracklines shapefile will already be included in the maps. If you have done the Append steps for these two shapefiles, then these two shapefiles should be up to date.

2. Save this map as a new file so that you can work with it later. Go to *File* → *Save As* → Save it in the proper park folder, e.g. EVER, and in the folder called YEAR_Survey_Maps, e.g. 2012_Survey_Maps. You can make a new copy of the map each time you create a map for a site within the park. This will make it easier to make changes later if necessary.

3. The waypoints and tracklines will already be in the map. Since the shapefile contains waypoints from all parks and all years, including pilot study work, waypoints need to be queried in order to display only relevant data. To display only the waypoints for a particular site or for this year: Right-click on the waypoints shapefile.

4. Select *Properties* → Click on *Definition Query* tab → Click on *Query Builder*

5. To select waypoints from a particular site: Double-click on *FILENAME* (If you don't see it, scroll down the list until you find it).

6. Click on the equal"=" sign. Then click on *Get Unique Values*. Double-click on the site you want to display. If you also want to sort by Date or another field follow the next steps. Otherwise click *OK*.

7. To sort by Date after the "site name" click on *And*. Select from the field list *Field_Date*. Click on the equal "=" sign. Then click on *Get Unique Values*. Select the correct field date for the site you are displaying. Click *OK*.

8. These maps have two labels called *Start* and *End*. These labels can be moved around on your map to show where along your trackline you started collecting data and waypoints and where you ended. This is also helpful to show the direction in which you were traveling during the field date. If you do not want to display the *Start* and *End* labels you can simply move them outside of the page layout, or you can delete them.

9. Before exporting the map, be sure the site name and field date in the title of the map are updated and correct for the area being displayed. Also, make sure the North Arrow, the Scale bar, and the Legend are all visible.

10. Once the map is ready for your Data Summary Reports they can be exported.

11. To export: Go to *File* → *Export Map* → browse to the appropriate *Survey Maps* folder under the spatial info folder. Z:\SFCN\Vital_Signs\Invasive_exotic_plants\spatial_info\EVER\2012_Surveys\2012_Survey_Maps. Name the file Year_Site_name, e.g. 2012_Flamingo_Campground. Save the files as *PNG* and make sure the resolution is 300. Click *Save*. Do this for all the other sites you visited this year. See Figure SOP G-1 for example of what your map will look like.

Figure SOP G-1. Example of a report map showing the project, park, site surveyed, date(s) of survey and labeled waypoints where exotic plants were found.

Creating report tables by site that correspond to site maps.

A data report table should then be created for each site in the Microsoft Access database denoting the species encountered, GPS waypoint number, coordinates for the GPS marks (UTM's in the NAD 83 projection in zone 17R should be listed for each GPS mark), and pertinent comments explaining site name, size of infestation, abundance of infestation, survey date, field of view estimates, and treatment data. To create a report, do the following:

1. Open the database and click on the *By Site* button under *Create Report*.
2. Select the Park, Year, and Site you want to create a report for and click "Create."
3. A report is generated showing the species, waypoint information, infestation size, comments, abundance, northing and easting information, field of view estimate, and treatment data, for the park, year, and site you selected.

A summary report table will be generated and pasted into the Summary section of the report.

Invasive Exotic Plant Early Detection Survey- Corridors of Invasiveness
Flamingo Campground, June 08, 2012, Everglades National Park

Species	Waypoint	Infestation Size (m)	Comments	Abundance	Northing	Easting	Field of View (m)				Treated	Treated With
Indigofora spicata	114	100 x 100	many; scattered	> 15	2780147	505306	10		10		No	
Sporobolus indicus	114	538 x 181	many; everywhere	> 15	2780147	505306	10		10		No	
Macroptilium lathyroides	115	50 x 50	many; scattered patches	> 15	2779964	505282	10		10		No	
Cyanthillium cinerum	116	50 x 50	few; scattered throughout	2-5	2779925	505498	10		10		No	
Cocos nucifera	117	3 x 3	1	1	2779971	505642	10		10		No	
Eleusine indica	117	538 x 181	many; everywhere	> 15	2779971	505642	10		10		No	
Dactyloctenium aegyptium	118	50 x 50	few; scattered patches	2-5	2780114	505570	10		10		No	
Sonchus asper	119	5 x 5	few	2-5	2780054	506102	10		10		No	
Cocos nucifera	120	10 x 10	few; scattered	2-5	2780124	505930	10		10		No	
Urochloa maxima	121	5 x 5	2 clumps	2-5	2780239	505732	10		10		Yes	glyphosate
Urochloa maxima	122	10 x 10	many clumps	> 15	2780198	505869	10		10		Yes	glyphosate
Cocos nucifera	123	1 x 1	1	1	2780335	505926	10		10		No	
Tridax procumbens	125	1 x 1	few; scattered	2-5	2780847	507798	10	E			No	
Indigofora spicata	125	1 x 1	few; scattered	2-5	2780847	507798	10	E			No	
Urochloa maxima	126	5 x 5	few; few clumps	2-5	2780926	507817	10	E			Yes	glyphosate
Sorghum halapense	126	5 x 5	few; small patch	2-5	2780926	507817	10	N	10	S	No	
Urochloa mutica	127	20 x 5	many; patch	> 15	2781038	507580	10	N	10	S	No	
Urochloa maxima	330	2 x 100		> 15	2781422	507741	5	E	5	W	No	
Sporobolus indicus	330	1 x 20		> 15	2781422	507741	5	E	5	W	No	

* May include areas outside high confidence field of view.

Figure SOP G-2. Example of a report table describing the waypoint information depicted on the report map (Figure SOP G-1).

Creating Species Infestation Summary Table for Data Summary Report (Appendix D).

To create the Species Infestation Summary Table report that goes into the Data Summary report (Appendix D) containing a summary table by species of number of infestations, total area, and percent infested within the field of view, do the following:

1. Open the database and click on the *Summary Report* button under *Create Report*.
2. Select the Park and Year you want to create a report for and click "Create."

3. A report is generated showing the species name, common name, whether it's new to park, the number of infestations, minimum size of infestation found, maximum size of infestation found, total area, and percent infested in the field of view.

4. A summary report table will be generated. To export as a PDF select *Print Preview*, then click on *PDF or XPS* under the *Data* section in the ribbon. Save the file to Z:\SFCN\Vital_Signs\Invasive_exotic_plants\documents\summaries_reports\2012_Corridors_Summary_Report_EVER\.

Species Name	Common Name	New to Park	Number of Infestations	Minimum Size (m^2)	Maximum Size (m^2)	Total Area (m^2)	Percent Infested in Field of View
Albizzia lebbeck	Woman's tongue	No	2	20	200	220	0.01013
Alternanthera philoxeroides	Alligatorweed	No	6	1	53675	67309	3.10003
Ardisia elliptica	Shoebutton ardisia	No	1	0	0	0	0.00001
Bucida buceras	Black olive	No	1	10	10	10	0.00044
Caesalpinia bonduc	Nickerbean	No	1	25	25	25	0.00115
Casuarina equisetifolia	Australian pine	No	4	1	5	13	0.00062
Casuarina glauca	Gray sheoak	No	1	871	871	871	0.04012
Catharanthus roseus	Madagascar periwinkle	No	1	4	4	4	0.00018
Cocos nucifera	coconut palm	No	1	100	100	100	0.00461

Figure SOP G-3. Example of Species Infestation Summary Table for Data Summary Reports (Appendix D).

Inserting maps and tables into the data summary report

These tables and maps are then inserted into a PDF version of the data summary report. The maps, tables, and data summary report are first exported or printed as PDF's from ArcMap, MSAccess, and MSWord respectively.

1. On a computer with Adobe Acrobat Pro, open the data summary report PDF.

2. Navigate to the page where the tables or maps are to be inserted.

3. Select Document -> Insert Pages -> From File.

4. Navigate and select the file to insert (i.e., the map file). NOTE: you can select more than one file to be inserted at a time.

5. For location select "After" then provide the page number it is to be inserted after. NOTE: this is not the written page number but instead is Adobe Acrobat's page count. If you navigate to this page and click on it, the correct page number will be inserted by default.

6. Save the file (YYYYMMDD_Park_CorridorsOfInvasiveness_SummaryReport.pdf).

The report is submitted as a Natural Resource Data Series (NRDS) report to the Washington office (WASO) where it receives a report number. The completed field report is then sent via email to the corresponding park and to the EPMT coordinator. In Everglades National Park (EVER), the reports should be sent to park botanists, and the park lead biologist. In Big Cypress National Preserve (BICY), the report should be sent to the park botanist, and to the park

Resource Management Chief. In Biscayne National Park (BISC), the report should be sent to the Resource Management Chief and to park.

A copy of the report is loaded to the Integrated Resource Management Applications (IRMA) website, linked on the SFCN web page, and archived.

Early Detection and Distribution Mapping System (EDDMapS) process

Data collected for this Vital Sign is also reported to the Early Detection and Distribution Mapping System (EDDMapS), located at http://www.eddmaps.org/training/EDDMapS.pdf.

One of the goals of the NPS-SFCN is to share the results of our vital sign monitoring with other researchers. The EDDMapS database is quickly becoming an important online database used by numerous agencies, organizations, and private citizens across the United States. Sharing our data with EDDMapS is one valuable way to contribute. In addition, EDDMapS may have valuable information about exotic species in our parks that we are able to gather and summarize. Steps for exporting to and importing from EDDMapS are both outlined below.

Export SFCN Data to EDDMapS

1. Open the *InvasiveExoticMonitoring.mdb* database.
2. Click on the *EDDMapS* button under *Create Report*.
3. Use the *Start Date* and *End Date* fields to select the date range desired for the data export. Select *Create*.
4. The EDDMapS export table will show up with data for the date range you selected. Now you need to save this as an excel file. Click the *External Data* toolbar menu in the ribbon and click the *Excel* button that sits to the right of the *Saved Exports* button. Click on the Browse button or copy and paste the file path below and add the name of the file to the end of the file path name, e.g. *2012_SFCN_Corridors_for_EDDMapS.xlsx*: Z:\SFCN\Vital_Signs\Invasive_exotic_plants\documents\summaries_reports\EDDMapS_Exports*2012_SFCN_Corridors_for_EDDMapS.xlsx*
5. Under *Specify export* options select *Export data with formatting and layout.* Click *OK* to complete the export.
6. Send the exported Excel file to Rebekah Wallace at bekahwal@uga.edu.

Import Data from EDDMapS

1. Until a web download form has been completed, regional EDDMapS data must be obtained directly from Chuck Bargeron. Send an email to Chuck at cbargero@uga.edu and request all data for Miami-Dade, Monroe, and Collier counties as a Microsoft Excel document.
2. Open the document in Microsoft Excel and make a few optional formatting changes.
    a. The file provided by EDDMapS will likely have dozens of columns. While these fields hold many items of interest, there are additional non-essential fields that can be deleted. The important fields that should be preserved are listed below. Be conscious that field names in the file provided by EDDMapS may change over time, so delete columns carefully.
        i. ObservationDate – date species was observed

ii. Latitude_D – decimal degree coordinate where the observation occurred
iii. Longitude_D - decimal degree coordinate where the observation occurred
iv. FLReporter – name of the observer/reporter
v. SUB_name – common name of the species observed
vi. SUB_genus – genus of the species observed
vii. SUB_species – species of the species observed

b. If the intent is to view only the plants observed within a certain time period (e.g. a certain year) then it may be best to sort the list in Excel by ObservationDate, select only those dates of interest, and paste the records in a new Excel worksheet.

c. In August 2011 NPS-SFCN asked EDDmapS to add a new field to the exported data that would allow plants to be separated from animals. When this field is added, it may be easiest to remove the animal records from within Microsoft Access by sorting the list on this new field, selecting only the plants, and pasting the plants into a new Excel worksheet.

3. Save your changes, and then close Microsoft Excel.
4. Open ArcMap and click the "Add Data" button. Browse to the location of the Excel document that was edited above, click the file, and then click the "Add" button.
5. Right-click the new table that has been added to the Table of Contents in ArcGIS and select "Display XY Data"
    a. For the "X Field" choose "Longitude_D" from the drop down list.
    b. For the "Y Field" choose "Latitude_D" from the drop down list.
    c. Click the "Edit" button underneath the Coordinate System description. Click "Select".
    d. Browse through "Geographic Coordinate Systems" to "World" and click on "WGS 1984." Click "Add."
    e. Click "OK" to exit the Spatial Reference Properties. Click "OK" again to display the XY data.
6. At this point a temporary file has been created, but it is best to create a permanent shapefile. Right-click the temporary points file and select "Data" and then "Export Data." Set the output shapefile to a suitable location on the server and click "OK." When asked if the exported data should be added to the map, select "Yes."
7. Click the "Add Data" button in ArcMap and bring in the boundary shapefile for the park of interest (e.g. Z:\GIS\EVER\data\basedata\boundary\EVER_boundary.shp)

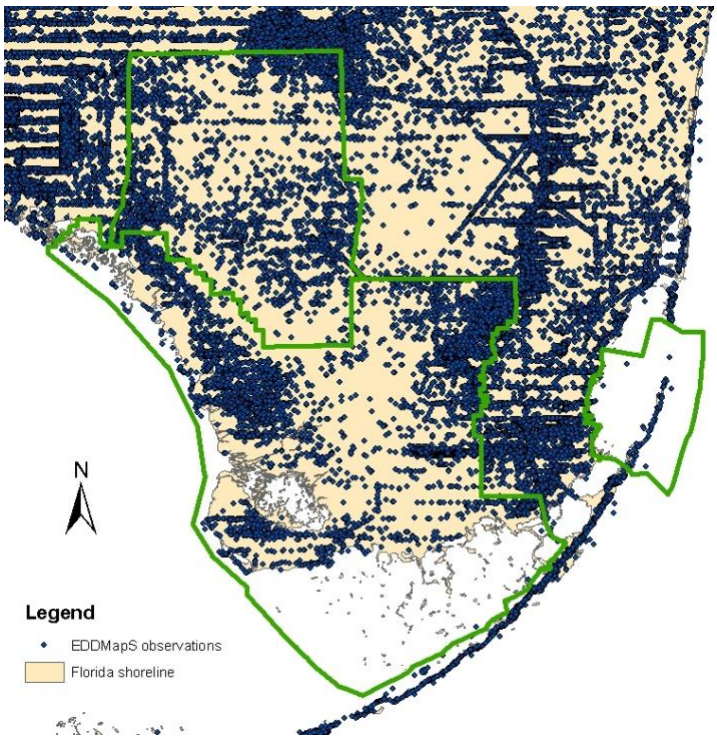


Figure SOP G-4. EDDMapS data imported and displayed in ArcMap along with the park boundaries for BICY, BISC, and EVER. Each point represents an exotic plant/animal observation reported to EDDMapS in south Florida.

8. To select all EDDMapS points that fall within the park boundary, click the "Selection" menu and "Select by Location."
    a. For the first drop-down list, ensure that "select features from" is selected.
    b. In the next section, click the checkmark in front of the EDDMapS shapefile created in step 8.
    c. For the second drop-down list, ensure that "intersect" is selected.
    d. For the final drop-down list, select the boundary shapefile that was added in step 9.
    e. Click "OK" to apply the selection. A sprinkling of points within the park boundary should be selected (Figure SOP G-4).
9. With the points still selected, right-click the EDDMapS shapefile and select "Open Attribute Table".
10. Right-click on the "SUB_name" column and click "Summarize".
11. Expand both "SUB_genus" and "SUB_species" and place a checkmark in front of both.
12. When asked if you would like to add the results to your map, click "Yes".
13. Locate the new table in the Table of Contents, right-click, and click "Open".
14. Each line indicates a distinct species found within that particular park. The "Count_SUB_name" field indicates how many times that species was reported. This table can be saved and exported to a permanent file.
15. Steps 7-14 can be repeated for each additional park being monitored.

Standard Operating Procedure H – Revising the Protocol

(Version 1.0)

Version #	Date	Revised by	Changes	Justification

Purpose

This log is to be used to track changes within the protocol. Changes can be suggested at any time following the procedures outline below.

Procedures

1. In the event the *South Florida/Caribbean Network Early Detection Protocol for Invasive Exotic Plants: Corridors of Invasiveness* requires editing, all edits must be reviewed for technical merit. Minor changes to the protocol will only require in-house review by network staff. Major changes in the protocol may require external review by subject matter experts.
2. Protocols edits and versioning are tracked in the revision history log attached to the narrative and to each SOP. Major changes results in an update by whole numbers (i.e. version 1.0, version 2.0, etc.) and minor changes by hundredths (e.g., version 1.01, version 1.02, etc.) Record the date of revision, author of the revision, describe the change, provide a rationale for the change, and assign a new version number.
3. Inform the Data Manager about the changes to the protocol narrative or SOPs, so the new version number can be incorporated in the project database metadata. The Data Manager may need to edit the database if the changes affect the database structure.
4. Post new protocol versions on the network website, IRMA (IRMA.nps.gov), and National Inventory and Monitoring Program protocol database and forward copies to all individuals with a previous version of the affected protocol. Update hard copy versions in the office (3 ring binder or comb-bound) by swapping out relevant sections. For glue-bound copies of the protocol which do not allow changes, either staple the revised section within the cover or discard the out of date versions.

Appendix A. Site Selection List

Site Name	Site Type	Survey Method	Park	Region	Site Arrival by	Site ID
Loop Road	road	roadside	BICY	South	truck	61
Fire Prairie road	road	roadside	BICY	South	truck	62
Midway	campground	roadside/walking	BICY	South	truck	63
Florida trail south Oasis	trail	walking	BICY	South	truck	64
Florida trail north Oasis	trail	walking	BICY	South	truck	65
Florida trail Loop road	trail	walking	BICY	South	truck	66
Gator Hook	trail	walking	BICY	South	truck	67
Pinecrest	campground	walking	BICY	South	truck	68
Mitchells Landing	campground	roadside/walking	BICY	South	truck	69
Tree Snail Hammock	trail	walking	BICY	South	truck	70
Monument Lake	campground	roadside/walking	BICY	South	truck	71
Monroe Station North	ORV trail	roadside	BICY	South	ATV	72
Monroe Station South	ORV trail	roadside	BICY	South	ATV	73
Skillet Strand	ORV trail	roadside	BICY	South	ATV	74
Burns Lake	campground	roadside/walking	BICY	South	truck	75
Burns Lake ORV	ORV trail	roadside	BICY	South	ATV	76
Ochopee	campground	roadside/walking	BICY	South	truck	77
Turner River road	road	roadside	BICY	South	truck	78
Concho Billie	ORV trail	roadside	BICY	South	ATV	79
Windmill Tram	ORV trail	roadside	BICY	South	ATV	80
Birdon road	road	roadside	BICY	South	truck	81
Wagonwheel road	road	roadside	BICY	South	truck	82
Jetport	road	roadside	BICY	South	truck	83
Eleven mile road	road	roadside	BICY	South	truck	84
Turner river road north	ORV trail	roadside	BICY	North	ATV	85
Bear Island	campground	roadside/walking	BICY	North	truck	86
Pink Jeep	campground	walking	BICY	North	truck/ATV	87
Bear grade road	road	roadside	BICY	North	truck	88
Perocchi Grade	road	roadside	BICY	North	truck	91
Florida trail I-75 south	trail	walking	BICY	North	truck	92
L-28 Interceptor canal	road	roadside	BICY	North	truck	93
Mile marker 70	trail	walking	BICY	North	truck	94
Tamiami Ranger Station	AB trail	airboat	BICY	South	airboat	95
Sunniland	road	roadside	BICY	North	truck	96
Mahogany Hammock	trail	walking	EVER	East	truck	97
BICY ORV Trail	ORV trail	roadside	BICY	North	truck/ATV	98
Elliott Key campground west	campground	walking	BISC	BISC	motor boat	1
Elliott Key campground east	campground	walking	BISC	BISC	motor boat	2
Elliott Key Loop Trail	trail	walking	BISC	BISC	motor boat	3
Spite Highway-Northern limit	road	roadside	BISC	BISC	motor boat-buggy	4
Spite Highway-Southern limit	road	roadside	BISC	BISC	motor boat-buggy	5
Adams Key Nature Trail	trail	walking	BISC	BISC	motor boat	6

Site Name	Site Type	Survey Method	Park	Region	Site Arrival by	Site ID
Mowry Canal	road	roadside	BISC	BISC	truck	8
Princeton Canal	road	roadside	BISC	BISC	truck	9
Military Canal	road	roadside	BISC	BISC	truck	10
Boca Chita campground	campground	walking	BISC	BISC	motor boat	11
Boca Chita Nature Trailhead	trail	walking	BISC	BISC	motor boat	12
Convoy Point	trail	walking	BISC	BISC	truck	13
Blackpoint	trail	walking	BISC	BISC	truck	89
Tiger Key	campground	walking	EVER	West	motor boat	14
Picnic Key	campground	walking	EVER	West	motor boat	15
Indian Key	campground	walking	EVER	West	motor boat	16
Rabbit Key	campground	walking	EVER	West	motor boat	17
Chokoloskee	campground	walking	EVER	West	truck	18
Lopez River	campground	walking	EVER	West	motor boat	19
Pavilion Key	campground	walking	EVER	West	motor boat	20
Mormon Key	campground	walking	EVER	West	motor boat	21
Watson Place	campground	walking	EVER	West	motor boat	22
New Turkey Key	campground	walking	EVER	West	motor boat	23
Darwin's Place	campground	walking	EVER	West	motor boat	24
Lostmans Five Bay	campground	walking	EVER	West	motor boat	25
South Lostmans	campground	walking	EVER	West	motor boat	26
Willy Willy	campground	walking	EVER	West	motor boat	27
Highland Beach	campground	walking	EVER	West	motor boat	28
Broad River	campground	walking	EVER	West	motor boat	29
Camp Lonesome	campground	walking	EVER	West	motor boat	30
Canepatch	campground	walking	EVER	West	motor boat	31
Graveyard Creek	campground	walking	EVER	West	motor boat	32
Northwest Cape	campground	walking	EVER	West	motor boat	33
Middle Cape	campground	walking	EVER	West	motor boat	34
East Cape	campground	walking	EVER	West	motor boat	35
Clubhouse Beach	campground	walking	EVER	West	motor boat	36
Flamingo Boat Launch	Boat launch	walking	EVER	East	truck	37
Little Rabbit Key	campground	walking	EVER	East	motor boat	38
North Nest Key	campground	walking	EVER	East	motor boat	39
Long Pine Key Campground	campground	roadside/walking	EVER	East	truck	40
Chekika Campground	campground	roadside/walking	EVER	East	truck	41
Old Ingraham Campground	campground	walking	EVER	East	truck	42
Ernest Coe	campground	walking	EVER	East	truck	43
Long Pine Key Trail	road	roadside	EVER	East	truck	44
Chekika Road	road	roadside	EVER	East	truck	45
Pahayokee	trail	walking	EVER	East	truck	46
Pineland Trail	trail	walking	EVER	East	truck	47
Shark Valley Tram road	road	roadside	EVER	East	truck	48
Otter Cave Hammock trail	trail	walking	EVER	East	truck	49
Borrow Pit Trail	trail	walking	EVER	East	truck	50

Site Name	Site Type	Survey Method	Park	Region	Site Arrival by	Site ID
Shark Slough airboat trail	trail	airboat	EVER	East	airboat	51
Taylor Slough airboat trail	trail	airboat	EVER	East	airboat	52
Anhinga trail	trail	walking	EVER	East	truck	53
Gumbo Limbo trail	trail	walking	EVER	East	truck	54
Christian Point trail	trail	walking	EVER	East	truck	55
Rowdy Bend	trail	walking	EVER	East	truck	56
Snake Bight	trail	walking	EVER	East	truck	57
Coastal Prairie	trail	walking	EVER	East	truck	58
Boy Scout Camp	campground	walking	EVER	East	truck	59
Research Road	road	roadside	EVER	East	truck	60
Blue Shanty Canal	canal	airboat	EVER	East	airboat	99
Paurotis Pond	boat launch	walking	EVER	East	truck	100
Nine Mile Pond	boat launch	walking	EVER	East	truck	101
West Lake	trail/boat launch	walking	EVER	East	truck	102
Bear Lake Road	road	roadside	EVER	East	truck	103
Flamingo Campground	campground	roadside/walking	EVER	East	truck	104
East Perimeter Road North	road	roadside	EVER	East	truck	105
East Perimeter Road South	road	roadside	EVER	East	truck	106
Key Largo Ranger Station	boat launch	walking	EVER	East	truck	107
Main Park Entrance	road	roadside	EVER	East	truck	108
Pine Glades Lake	trail	walking	EVER	East	truck	109

Appendix B. Field Data Sheet.

NPS - SFCN Invasive Exotic Plant Early Detection Monitoring

Date:	GPS Unit #:	Starting GPS Mark:	Ending GPS Mark:
Park:	Site:		
Observers:	Comments:		

Survey Type (circle one) **Walking** **Driving** **Airboat** **Driving / Walking**

Species	Mark	Infested Area (m) Length	x Width	Abundance	Comments	Treated Y/N	With	Habitat	Field of View estimate (m) (circle direction)		# Pics
				1 2 3 4 5					N S E W	N S E W	
				1 2 3 4 5					N S E W	N S E W	
				1 2 3 4 5					N S E W	N S E W	
				1 2 3 4 5					N S E W	N S E W	
				1 2 3 4 5					N S E W	N S E W	
				1 2 3 4 5					N S E W	N S E W	
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				1 2 3 4 5					N S E W	N S E W	
				1 2 3 4 5					N S E W	N S E W	
				1 2 3 4 5					N S E W	N S E W	
				1 2 3 4 5					N S E W	N S E W	

Abundance Categories (based on number of individuals) : **1** = 1 **2** = 2 - 5 **3** = 6 - 10 **4** = 11 - 15 **5** = > 15

Appendix C. Field Safety.

Page

Users should check for updated versions in Z:\Safety\ on the SFCN Florida server. Although every attempt will be made to keep this protocol current, it's possible for a delay to occur between updates of a Safety SOP in Z:\Safety\ and updates of this protocol.

Safety First!!! Field Safety Sign-out Information

Objective: To know where field personnel are, when they are overdue from returning from the field, when help should be sent, and to have enough information to give to searchers to make them easy to find.

Date(s):

List all crew members (crew leader first): _____

_____

_____

Time of departure: **Time expected to return:**

Time to send help:

Location(s) (please attach a copy of any maps you make and give enough information to direct a search crew)**:**

☐ **BICY** ☐ **BISC** ☐ **EVER** ☐ **DRTO** ☐ **WCA3A** ☐ **Other**

Ramp

☐ **Black Point Marina** ☐ **BISC Headquarters** ☐ **Flamingo**

☐ **Everglades City** ☐ **Other:**

Contact info

Radio #: **Cell phone #:** **Home phone #:**

Will you be in cell phone range? Yes ☐ **No** ☐ **Partial** ☐ **.**

If overdue call

☐ **EVERGLADES Dispatch: 305-242-7740** ☐ **911**

☐ **Dry Tortugas Site Manager: 305-242-7700**

☐ **U.S. Coast Guard: 305-535-4300, 305-535-4304, 305-535-4582**

Truck/Car

☐ **Ford F250 pickup – 2012, green, 4x4, crew cab, long-bed, tag # I517061**

☐ **Ford F250 pickup – 2008, white, 4x4, crew cab, long-bed w/cap, tag # I411795**

☐ **Ford F250 pickup – 2007, white, 4x4 crew cab, short-bed, tag # I411786**

☐ **Chrysler Grand Caravan minivan – 2005, dark blue, tag # I410018**

☐ **Ford Expedition (XLT) SUV (Tony's) – 2009, white, tag # G62-0210F**

☐ **Ford Fusion – 2010, white, tag # I413445**

☐ **Honda ATVs – 2008/2009, red w/NPS logos, 20-ft white cargo trailer, tag # I411795**

Boat

☐ **TwinVee Catamaran w/NPS logo, length 29 ft, tag # I263404**

☐ **TwinVee Catamaran, length 19 ft, tag # I413447**

☐ **Airboat w/NPS logo, length 14 ft, tag # I411792**

☐ **Aluminum workboat "Sparky", length 20 ft, tag # I411792**

☐ **M/V Fort Jefferson – Satellite Ph: 808-659-5146, Cell Ph: 305-215-4767**

☐ **Canoe, red, Osagian "Missourian", length 17'**

☐ **Other:**

If staying overnight

Lodging you are staying in: **Lodging phone number:**

Name of field crew's Nightly Call-in Contact:

Expected call-in time:

If going on a helicopter

Name of the company:
Name of the pilot:
Contact info for pilot & company:

Precise take-off point: **Take-off time:**

Precise landing point: **Landing time:**

☒ Approval for permission to work 8 hours comp time per day.

_____

SFCN Airboat Go/No Go Checklist

Items needed:

A. Airboat safety action packer
B. Airboat tool box
C. Orange key box
D. Park radio
E. PFD's for every person
F. Eye protection for every person
G. Ear muffs for every person
H. Check log book for comments from previous user

Airboat Check:

1. Remove airboat cover and stow in back of the truck.
2. Make sure you have a bow line and that it's attached to the bow of the airboat.
3. Does the airboat have fuel? Use 89 octane gas.
4. Check prop for damage. A few small dings are OK, but if there are many dings (>10), any chunks missing, or if the protective metal covering is peeling off, then that particular prop must be replaced.
5. Check prop bolts, making sure they are tight.
6. Check the bilge pumps for any loose or foreign material.
7. Check the engine cage for broken wiring and rusting.
8. Check the engine for oil leaks or radiator leaks, and make sure the spark plug wires are firmly attached, and that there are no loose nuts and bolts anywhere on the engine.
9. Check oil level.
10. Check radiator water level.
11. Check batteries for water and use volt meter to ensure batteries are holding 12 volts of charge.
12. Start the airboat engine to ensure everything is working properly.

Trailer Check:

1. Check tire pressure.
2. Ensure tire hubs are greased. Look for a sinking of the center plate where the grease gun nipple attachment is.
3. Properly attach trailer to truck. Make sure truck has a 2 inch ball, and that the attaching wires are crossed forming an X.
4. Make sure the trailer lights are working. This includes brake lights, running lights, turn signals, and hazard lights.

Before Departing:

1. Call Dispatch 305-242-7740 before and after each trip.
2. Fill out office safety form.
3. Put in the airboat plugs.
4. Always bring a large lunch and plenty of water. Bring 5 gal. water cooler.
5. Frog City gate combo 5280. Gate to Taylor Slough takes the Z key.

SFCN ATV Go/No Go Checklist

Items needed:

A. ATV keys (in ATV's ignitions and two spares in the SFCN office key box)
B. ATV tool boxes (in ATV cargo box)
C. ATV safety action packer (must be prepared prior to departure)
D. Park radio
E. Safety gear for every person (Helmets, goggles, gloves, boots, long pants)
F. ASI ATV Rider Course Completion Card
G. Spare gas (several 5 gal. containers of regular unleaded)
H. Check log book for comments from previous user (in ATV tool box)

ATV Pre-ride Check:

1. Check for, and remove any dirt vegetation or other debris that could interfere with the proper operation of the vehicles.
2. Check level of engine oil and add if necessary, check for oil leaks. The ATV's use SAE 10W-30 4 stroke engine oil.
3. Check fuel level and add fuel if needed (regular unleaded), check for leaks.
4. Check tires, air pressure, adjust if needed. Recommended tire pressure is 3.6 psi for all tires. Also look for signs of damage.
5. Make sure all axle nuts are tightened. Nuts will take an 11/16 or 17mm tool.
6. Check driver-shaft boots. Look for damage or leaks.
7. Check the air cleaner housing, clean if needed and or replace air cleaner if needed. Air cleaner can be found under the seat inside the black square housing.
8. Check for deposits in the drain tube, clean if needed. The clear drain tube hangs in the rear underside of the ATV, next to the underside of the air cleaner housing.
9. Walk around ATV and look for anything unusual, such as a leak or loose cable.
10. Check the cable housings for wear. Check the fittings for looseness. Tighten or replace as needed.
11. Check battery (under the seat), make sure it's completely charged. Check volts with the voltmeter/load tester. Check battery water.
12. Make sure the headlights, brake lights, and taillights are working properly.
13. Start the ATV engine to ensure everything is working properly.
14. For more specific information please refer to the ATV owner's manual located in the ATV tool box, inside the cargo box.

Trailer Check:

1. Check trailer tire pressure. 50 psi maximum.
2. Ensure tire hubs are greased. We have grease in garage for this purpose.
3. Properly attach trailer to truck. Make sure truck has a 2 inch ball, and that the attaching wires are crossed forming an X.
4. Make sure the trailer lights are connected and working. This includes brake lights, running lights, turn signals, and hazard lights.

Before Departing:

5. Call Dispatch 305-242-7740 before and after each trip.
6. Fill out office safety form.
7. Put in the airboat plugs.
8. Always bring a large lunch and plenty of water. Bring 5 gal. water cooler.

Vehicle (Truck) Go/No-Go Checklist

In Office:

1. Check calendar to make sure vehicle is not already signed out.
2. Sign vehicle out with your initials on the office calendar.
3. Note vehicle on safety sign-out sheet and post on office float plan board.
4. Get keys and ensure spare set of keys is in key cabinet.

In Vehicle:

a. Walk around vehicle to inspect for dents or other visible damage.
b. Ensure there are no nails or cracks on tires.
c. Check air pressure in each tire, including spare tire.
d. Ensure you have sufficient fuel to complete your mission.
e. Make sure action packers with emergency equipment are in back of truck.
f. Make sure no warning lights are on in the dashboard indicating low fluid levels or other issues.
g. Consult manual in glove box if any lights are on, or if there is something you are unfamiliar with.
h. Log date, initials, destination, and beginning mileage in logbook.

Underway:

a. DO NOT over-crank: turn the key to the ON, wait, turn the key to START and immediately release key.
b. DO NOT use cell phone while driving – that means no talking and no texting – pull over if you must.

Parked:

Place magnetic NPS sign on dashboard when parking at a marina or a remote site.

In Case of Emergency:

a. Consult user manual - look in action packers for tools, etc.
b. Consult warranty information.
c. Notify office, and consult on how to proceed.

On Way Back:

Fuel up if there's less than half a tank left.

In Office:

a. Put fueling receipt in envelope, bring them up if there are too many.
b. Log ending mileage, fuel, any other comments.
c. Park vehicle so it blocks our boats/trailers - do not block vehicles set up for a mission the next day.
d. Remove garbage from the vehicle, shake off dust mats especially if you got them muddy.
e. Take down and file your float plan.
f. Put keys back in cabinet.
g. IMMEDIATELY report any problems encountered (noise, vibrations, etc).

SFCN Motorboat

Minimum Safety Requirements for SFCN Motorboats

1. Personal Flotation Devices (PFD)

Acceptable type I, II, III and V PFDs (also known as Life Jackets) must be U.S. Coast Guard approved, in good serviceable condition, and of suitable size for the each person on the boat. Wearable PFDs shall be "readily accessible." Type IV, or “throwable” devices shall be "immediately available." PFDs shall NOT be stored in unopened plastic packaging. Boats 16 Feet or longer must also have one Type IV.

2. Visual Distress Signals (VDS)

Recreational boats 16 feet and over used on coastal waters or the Great Lakes are required to carry a minimum of either 1) three day and three night pyrotechnic devices, 2) one day non-pyrotechnic device (flag) and one night non-pyrotechnic device (auto SOS light) or 3) a combination of 1) and 2).

3. Fire Extinguishers

Fire extinguishers are required if one of the following conditions exists: (1) Inboard engine(s); (2) Closed compartments that store portable fuel tanks; (3) Double bottom hulls not completely sealed or not completely filled with flotation materials (4) Closed living space (5) Closed stowage compartments that contain flammable materials or (6) Permanently installed fuel tanks.

NOTE: Fire extinguishers must be readily accessible and verified as serviceable.

Minimum number of extinguishers required

Boat Length	No Fixed System	With Fixed System
Less than 26'	one B-1	none
26' to less than 40'	two B-1 or one B-2	one B-1
40' to 65'	three B-1 or one B-1 & one B-2	two B-1 or one B-2

4. Sound Producing Devices / Bell

To comply with Navigation Rules and for distress signaling purposes all boats must carry a sound producing device (whistle, horn, siren, etc.) capable of a 4-second blast audible for ½ mile.

5. Navigation Lights

All boats must be able to display navigation lights between sunset and sunrise and in conditions of reduced visibility. Boats 16 feet or more in length must have properly installed, working navigation lights and an all-around anchor light capable of being lit independently from the red/green/white "running" lights. The following configuration is standard for power boats less than 40 feet Length Overall (LOA). The mast and stern light may be combined as an all-round white light or displayed separately as in Figures Appendix C-1 and Appendix C-2.

Figure Appendix C-1. Combined all-round white mast and stern light.

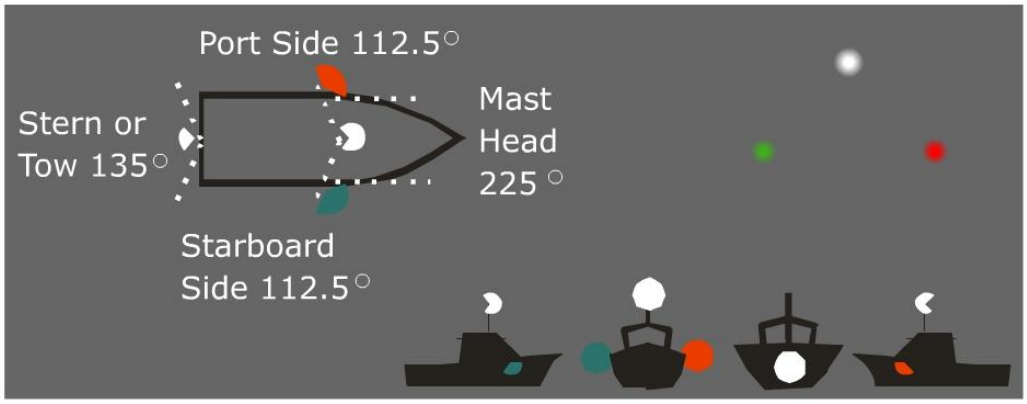

Figure Appendix C-2. White mast and stern lights displayed separately.

6. Overall Vessel Condition

a. Deck free of hazards and clean bilge

The boat must be free from fire hazards, in good overall condition, with bilges reasonably clean and visible hull structure generally sound. The use of automobile parts on boat engines is not acceptable.

b. Safe Electrical and Fuel Systems

The electrical system must be protected by fuses or manual reset circuit breakers. Switches and fuse panels must be protected from rain or water spray. Wiring must be in good condition, properly installed and with no exposed areas or deteriorated insulation. Batteries must be secured and terminals covered to prevent accidental arcing.

7. Emergency Positioning Indicating Radio Beacon: EPIRB

Model PLB-350b AquaLink 406 MHz GPS. The EPIRB is kept in the office and available for use during boat operations over open water or anytime boat operators may choose to have it on board.

a. Manual Operation

The unit is a category II beacon and is designed to operate manually. There are two ways to activate the beacon:

i. Remove it from its bracket and place it in water.

ii. Lift the activation/test switch to a vertical position, slide the switch toward the antenna then push the switch down to the opposite side of the beacon.

b. Beacon self-test

To test the device, momentarily lift the activation switch to a vertical position and hold it for at least one second and at most four seconds. A beep indicates the initiation of the self-test sequence. The test will check for battery capacity, beacon message errors, circuit board functionality, signal strength, GPS readiness and led functionality. At the end of the test the display will show that the self-test passed.

It is only necessary to test the device once every six months and before each prolonged trip because of the infrequent use of the device. It should not be tested more than once a month because it is designed to support a total of 60 self-tests, or one self-test a month for the 5 year duration of the battery.

Operation Procedures

The following guidelines are basic and tailored to expected conditions in the Virgin Islands, but are not all-inclusive. Operators should seek comprehensive guidelines in the MOCC and "Rules-of-the-Road" manuals.

1. Basic operation guidelines

a. Weather

Always check the weather conditions and forecast before leaving the dock.

IMPORTANT: Boaters rarely encounter serious trouble in calm weather, while in severe weather the decision to cancel a mission is obvious. Boat operators may decide that weather conditions are not severe enough to cancel a mission, but it is important to remember that in inclement weather a relatively small deterioration may prove dangerous.

b. Pre-ignition check

Once a visual inspection has been adequately performed, turn on the battery switches in the splashwell.

c. Turn engines on

Insert the kill switch key into the kill switch slot. This device may be attached to pants or a jacket by a lanyard when worn. This safety device is designed to remove the kill switch key from its slot, thus shutting down the engine, if the operator is forcefully dislodged from the pilot area.

Turn on engine. Verify that the water cooling system is operational by observing the water pump outlet (see Figure Appendix C-3). If a water stream is not visible within a few moments, shut the engine off. Check for a clog in the outlet. If the hole is clear and no water discharges, the engines must not be run as they are likely to overheat. A boat mechanic should evaluate the situation to check the impeller, water pump or other cooling system defect.

Figure Appendix C-3. Water pump indicator.

d. Fuel status

Make sure the boat has enough fuel to safely accomplish objectives and allow for emergencies. Generally it is unwise to travel if the boat has less than half a tank of fuel.

When fueling the boat, always estimate the amount of fuel needed before fueling by checking the boat log and fuel gauge.

e. Post lookouts

All passengers should behave as lookouts when underway. Often a passenger will see hazards to navigation before the operator. Acknowledge all communications from lookouts as these are attempts to assist in safely navigating the vessel.

Radio Channel Sheet for National Park Service Radios in South Florida

To set group - Remove face plate and press [#] key, then group number. Then press [ENT] key or wait 5 seconds.
LOBATT display and yellow indicator light flashing means low battery
Remember that mixed mode receives analog and digital signals but only sends digital signals.
Dispatch call number - 784
Analog (A), Mixed (M), Digital (D)

Everglades		Biscayne		Big Cypress		Dry Tortugas	
Group 1 (A)		**Group 4 (A)**		**Group 7 (A)**		**Group 10 (A)**	
Group 2 (M)		**Group 5 (M)**		**Group 8 (M)**		**Group 11 (M)**	
Group 3 (D)		**Group 6 (D)**		**Group 9 (D)**		**Group 12 (D)**	
Channel		Channel		Channel		Channel	
1)	Everglades Simplex	1)	Biscayne Simplex	1)	Everglades Simplex	1)	Fort Jefferson Simplex
2)	Research Tower (Long Pine Key Rept.)	2)	Elliott Key Rept.	2)	Research Tower (Long Pine Key Rept.)	2)	Fort Jefferson Local
3)	Flamingo Rept.	3)	Cape Florida Rept.	3)	Flamingo Rept.	3)	Fort Jefferson District Repl
4)	Key Largo Rept.	4)	Convoy Point Rept.	4)	Key Largo Rept.	4)	Marine
5)	Pinecrest Rept.	5)	Customs Simplex	5)	Pinecrest Rept.	5)	Marine
6)	Gulf Coast (Everglades City Rept.)	6)	Customs Rept.	6)	Gulf Coast (Everglades City Rept.)	6)	Marine
7)	East Everglades Rept.	7)	Everglades Simplex	7)	East Everglades Rept.	7)	Marine
8)	Fire Simplex	8)	Key Largo Rept.	8)	Biscayne Simplex	8)	Marine 1
9)	Fire Rept. (Research Tower)	9)	Marine 1	9)	Elliott Key Rept.	9)	Marine
10)	Fire Ins	10)	Marine 2	10)	Cape Florida Rept.	10)	Marine
11)	Fire Red	11)	Marine 2	11)	Convoy Point Rept.	11)	Marine
12)	Fire White	12)	Marine 1	12)	Customs Simplex	12)	Marine
13)	Fire Blue	13)	Marine 1	13)	Big Cypress Simplex	13)	Marine
14)	Weather	14)	Marine 6	14)	Oasis Rept.	14)	Marine
		15)	Marine 7	15)	Carnestown Rept.	15)	Weather
		16)	Weather	16)	Weather		

JOB SAFETY ANALYSIS WORKSHEET

Title of Job/Operation	**Corridors of Invasiveness - Monitoring**		**Date**	**05/01/2013**	**No.** **1**
Position/Title(s) of Person(s) Who Does Job	**SFCN Botanist**		**Name of Employee Observed**		
(Biological Technician) & EPMT Technician			**Analysis Made By**	Brooke Shamblin	
Department					
Section	**South Florida / Caribbean Network**		**Analysis Approved By**	Kevin Whelan	

Sequence of Basic Job Steps	Potential Accidents or Hazards	Recommended Safe Job Procedures
Supplies, equipment, and PPE needed:	First aid kit, snake bite kit, appropiate safety garments (gloves, boots, long pants, long-sleeved shirt), fully charged NPS radio, water, lunch, buddy, Tecnu at headquarters.	
Hiking trails to start monitoring	1. Cause injury or contamination when falling while carrying field equipment or herbicide 2. Snake bite 3. Hit by car while walking along sides of roads	1. Secure all field equipment high on body and limit amount of items needed to be carried by hand 2. Wear proper safety garments (gloves, boots, long pants and long sleeved shirts) when transporting herbicide 3. When encountering a snake, keep a safe distance and carry a snake bite kit in the first aid kit. If bitten by a poisonous snake, seek medical attention immediately; Contact EVER dispatch at 305-242-7740 and/or Miami Poison Control Center at 800-222-1222 4. Wear orange vests while walking along roads, parking lots, campgrounds. Be aware of vehicles coming towards you and be prepared to move. Some drivers tend to unconsciously steer towards what their eyes are looking at.
Monitoring for exotic plants	1. Fall on jagged limestone 2. Poked, stuck, or pierced by sharp branches 3. Allergic reactions to poisonous plants 4. Overexertion 5. Sun and heat exposure	1. Wear sturdy shoes and step carefully to avoid falls 2. Pay close attention to obstacles such as branches or tree limbs that stick out or hang low 3. Learn identification and avoidance of poisonous vegetation. Rinse and cleanse before and after exposure with Tecnu 4. Drink plenty of water for long field day, take breaks, wear light but protective clothing
Spraying of herbicide	1. Herbicide contamination	1. Keep herbicide in a separate storage compartment when travelling 2. Only a certified applicator handles the herbicide 3. The certified applicator wears protective equipment when handling herbicide and follows the safety guidelines outlined in Natural area weed management: A training manual for restricted use pesticide applicators (Langeland, 2001)

JOB SAFETY ANALYSIS WORKSHEET

Title of Job/Operation	**Corridors of Invasiveness - Modes of Transportation**		**Date**	**05/01/2013**	**No.** **1**
Position/Title(s) of Person(s) Who Does Job	**SFCN Botanist**		**Name of Employee Observed**		
(Biological Technician) & EPMT Technician			**Analysis Made By**	Brooke Shamblin	
Department	**Department of Interior - National Park Service**				
Section	**South Florida / Caribbean Network (SFCN)**		**Analysis Approved By**	Kevin Whelan	

Sequence of Basic Job Steps	Potential Accidents or Hazards	Recommended Safe Job Procedures
Transit and surveying in truck	1. Accident/collision 2. Potential accident involving weather (flooding, slick roads)	Supplies, equipment, and PPE needed: Action packer with safety equipment, magnetic yellow flashing light, orange vests, park radio 1. Before leaving office read the Truck "Go – No Go" safety checklist and check the truck log book comments section for any problems 2. Operate vehicle at posted speed limits or below, operators must have a valid Florida driver's license, do not send text messages or talk on the phone while driving, always keep focus while operating vehicle. 3. Use magnetic yellow flashing light when travelling at low speeds. 4. Check the radar and weather before leaving office. Check weather reports on park radio weather channel 5. Call Dispatch before & after each trip and fill out office safety form
Transit on site and between sites on ATV	1. Accident	Supplies, equipment, and PPE needed: ATV safety action packer, helmets, goggles, boots, long pants, park radio, ATV toolbox, ASI ATV Rider Course Completion Card, spare gas, ATV log book 1. Always wear protective equipment (helmet, gloves, boots) and operate ATV at a safe speed. Follow safety guidelines received in ATV training 2. Read the ATV "Go – No Go" safety checklist before transporting and riding ATV's 3. Only ATV trained operators are allowed to operate ATV 4. Check the radar and weather before leaving office. Check weather reports on park radio weather channel 5. Call Dispatch before & after each trip and fill out office safety form

Sequence of Basic Job Steps	Potential Accidents or Hazards	Recommended Safe Job Procedures
Transit by motorboat to islands in BISC; Ten Thousand Islands, and Florida Bay in EVER	1. Boat will run aground in shallow areas 2. Boat will be "high and dry" after returning from island 3. Boat will have cut loose from anchor or anchor doesn't hold 4. Boating accident/collision 5. Potential accident involving weather (lightning storm)	Supplies, equipment, and PPE needed: All required Coast Guard safety equipment will be located on vessel; PFD's for all personnel on boat, first-aid kit, VHF radio, NPS radio, visual distress signals, fire extinguishers, sound producing devices, flares and throw bag. 1. Read the motorboat "Go – No Go" safety checklist before going out 2. Ensure tides are high and do not go at speed if there is a question of shallows 3. Always bring water depth chart 4. Make sure to tie line around a sturdy root or branch of mangroves tree (if there is no harbor or dock) and always tie two points of the boat to the mangrove tree 5. Maintain proper lookouts 6. Only MOCC certified operators drive the boat 7. Operate motorboat under DOI MOCC safe operation guidelines 8. Check the radar weather before leaving office and check park radio weather channel throughout the day for weather reports 9. Call Dispatch before & after each trip and fill out office safety form
Airboat surveying	1. Boating accident 2. Potential accident involving weather (lightning storm)	Supplies, equipment, and PPE needed: Airboat safety action packer, airboat toolbox, park radio, PFD's & eye protection & ear muffs for each person, airboat log book 1. Read airboat "Go – No Go" safety checklist and airboat log comment section for any problems 2. Maintain proper lookouts 3. Only MOCC and airboat certified operators drive the boat 4. Check the radar weather before leaving office and check park radio weather channel throughout the day for weather reports 5. Call Dispatch before & after each trip and fill out office safety form

Appendix D. Data Summary Report Template

Attached is a Corridors of Invasiveness data summary report template. This template is designed so the yellow highlighted areas can be quickly updated each year as necessary.

National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

Corridors of Invasiveness Data Summary Report

Parkname, Year

Natural Resource Data Series NPS/SFCN/NRDS—20XX/XXX

Brooke Shamblin

National Park Service
South Florida / Caribbean Network
18001 Old Cutler Rd., Suite 419
Palmetto Bay, FL 33189

Month Year

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado publishes a range of reports that address natural resource topics of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies,

The Natural Resource Data Series is intended for the timely release of basic data sets and data summaries. Care has been taken to assure accuracy of raw data values, but a thorough analysis and interpretation of the data has not been completed. Consequently, the initial analyses of data in this report are provisional and subject to change.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner. Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This report is available from the National Park Service South Florida / Caribbean Network (http://science.nature.nps.gov/im/units/sfcn/) and the Natural Resource Publications Management website (http://www.nature.nps.gov/publications/nrpm/).

Please cite this publication as:

Shamblin, Brooke. 20XX. Corridors of Invasiveness Data Summary Report: Parkname, Year. Natural Resource Data Series NPS/SFCN/NRDS—20XX/XXX. National Park Service, Fort Collins, Colorado.

Introduction

This report summarizes the locations surveyed and the new exotic species detected while conducting Corridors of Invasiveness surveys in <parkname>.

Methods

The basic approach involves scanning major "corridors of invasiveness" for new exotic plant species, e.g., paved and unpaved roads, trails, trail heads, off road vehicle (ORV) trails, boat ramps, campgrounds, and canals. Surveys are conducted while walking or while driving slowly in a vehicle, all-terrain vehicle, airboat, or boat. The high confidence "Field of View" is recorded (defined as the distance in meters one has reasonably high confidence one can view without too much obstruction for the purpose of sighting exotics in all three canopy layers (herb, shrub, tree). However any exotics seen outside this field of view are also reported but not used in calculations of percent infested area within field of view. Sampling is optimized using a two person crew, a trained botanist from the South Florida\Caribbean Network (SFCN) and a certified pesticide applicator from the Exotic Plant Management Team (EPMT). If infestations are small, they are treated immediately by the EPMT crew member. If large, they are quickly reported to park staff and the Exotic Plant Management Team specialist. Complete methods are described in the protocol "South Florida\Caribbean Network Surveillance and Rapid Response Protocol for Invasive Exotic Plants, Corridors of Invasiveness" (Shamblin *et al.,* 2012)

Surveys were conducted by <give names> between the dates of XXX and XXX.
<Give details of what sites visited using what methods, for example:
Five sites were visited within Everglades National Park (EVER) covering a total distance of 76.28 miles (Table 1). The sites included roadside surveys of Chekika (Figures 1 & 2), Long Pine Key campground (Figure 3), Flamingo Pump Station, and the Flamingo campground (Figure 4) Walking surveys were conducted on hiking trails at Christian Point (Figure 5), Rowdy Bend (Figure 6), and part of the Long Pine Key campground (Figure 7). Airboat surveys were conducted along the Blue Shanty Canal (Figure 8 and the main airboat trail from Frog City to Irongrape Hammock (Figure 9).>

<explain if there was anything special that year that disrupted surveys, e.g. hurricane, etc.>

Table 1. Total distance covered.

Site	Track Length (mi)
Chekika Rd	14.09
Long Pine Key	10.39
Blue Shanty Canal	20.48
Flamingo (Christian Pt. Trail, Rowdy Bend Trail, Campground, Pump Station Area)	3.19
Shark Slough	28.13
Park Total:	76.28
2009 Pilot Study Total:	115.43

Results and Discussion

Summary

<report summary of results, and anything usual that managers should be made aware of. For example:
A total of 46 exotic species were encountered during the pilot study. The most common exotic species encountered in Everglades National Park were *Schinus terebinthifolius*, *Sporobolus indicus*, *Stenotaphrum secundatum* and *Zoysia sp* (Table 2). Of these 46 species, 15 (32.6%) were new records of exotics found in the parks. The new species include *Washingtonia robusta*, *Bougainvillea spectabilis*, *Auracaria heterophylla*, *Mangifera indica*, *Stenotaphrum secundatum*, *Panicum repens*, *Senna pendula*, and *Emilia sonchifolia*.

Appendix A contains a summary table by species of number of infestations, total area, and percent infested within the field of view. Appendix B contains maps of the exotic locations within each Site and corresponding tables. Appendix C contains photos of new exotics.

Survey issues and improvements

<include anything that should be noted for future surveys, e.g. difficulty with access, locked gates, low water, etc.>

Literature Cited

Shamblin, R. B., K. R. T. Whelan, and R.M. Vargas. 2012. South Florida\Caribbean Network Surveillance and Rapid Response Protocol for Invasive Exotic Plants, *Corridors of Invasiveness*. Natural Resource Report NPS/SFCN/NRR—2012/XXX. National Park Service, Fort Collins, Colorado.

“Appendix A. Species Infestation Summary Table.”

Species Name	Common Name	New to Park	Number of Infestations	Minimum Size (m^2)	Maximum Size (m^2)	Total Area (m^2)	Percent Infested in Field of View
Albizzia lebbeck	Woman's tongue	No	2	20	200	220	0.01013
Alternanthera philoxeroides	Alligatorweed	No	6	1	53675	67309	3.10003
Ardisia elliptica	Shoebutton ardisia	No	1	0	0	0	0.00001
Bucida buceras	Black olive	No	1	10	10	10	0.00044
Caesalpinia bonduc	Nickerbean	No	1	25	25	25	0.00115
Casuarina equisetifolia	Australian pine	No	4	1	5	13	0.00062
Casuarina glauca	Gray sheoak	No	1	871	871	871	0.04012
Catharanthus roseus	Madagascar periwinkle	No	1	4	4	4	0.00018
Cocos nucifera	coconut palm	No	1	100	100	100	0.00461
Cynodon dactylon	bermudagrass	No	2	4	20	24	0.00111
Dactyloctenium aegyptium	Crowsfoot grass	No	1	4	4	4	0.00018
Eleusine indica	Indian goosegrass	No	1	10	10	10	0.00046
Ficus microcarpa	Indian laurel	Yes	1	200	200	200	0.00921
Hydrilla verticillata	Waterthyme	No	1	1695	1695	1695	0.07808
Indigophera suffruticosa	Anil de pasto	Yes	1	1	1	1	0.00005
Lantana camara	Lantana	No	3	0	3056	3058	0.14084
Leucaena leucocephala	lead tree	No	3	1	200	224	0.01030
Ludwigia peruviana	Peruvian primrosewillow	No	2	200	353	553	0.02546
Lygodium microphyllum	Small-leaf climbing fern	No	1	4	4	4	0.00018
Melaleuca quinquenervia	cajeput tree	No	24	1	1655	1930	0.08890
Neyraudia reynaudiana	Burma reed	No	7	1	353	866	0.03988
Panicum repens	Torpedo grass	No	11	2	101	454	0.02089

“Appendix B. Exotic Plant Locations and Corresponding Maps”

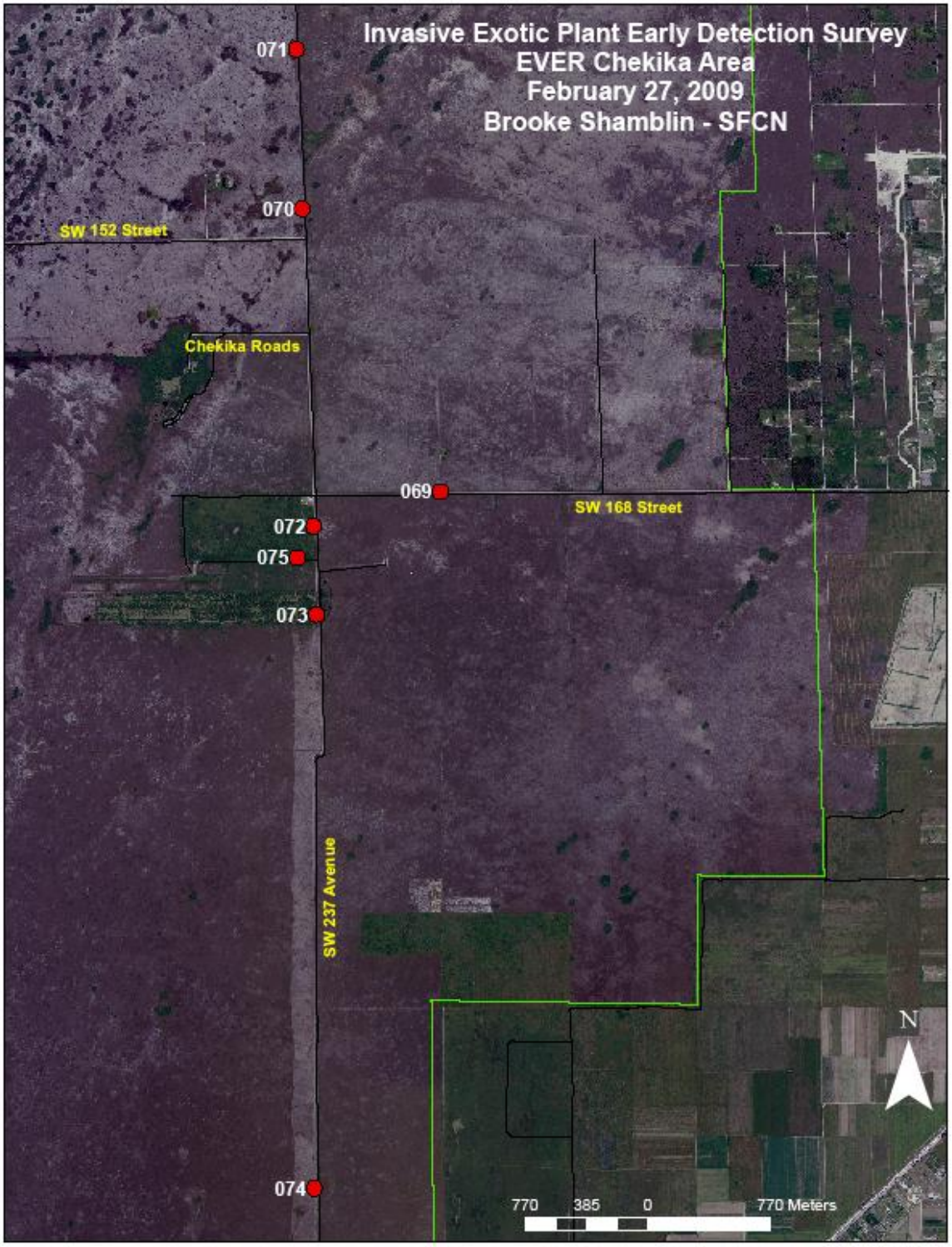

Figure 1. Map of the Chekika area roadside survey in Everglades National Park.

Table 2. Table of surveys in Everglades National Park with associated waypoints and list of exotic species

Waypoint	Species	LAT	LONG	Northing	Easting	Comments	Treated ?	How Treated
69	Washingtonia robusta	25.6084	80.5671	2832391	543465	highly disturbed area at urban/park interface along SW 168 St.		
70	Tradescantia spathaceae	25.6245	80.5757	2834166	542598	patch of oyster plants on both sides of Chekika Rd. A few more clumps to N also.		
71	Pteris bahamensis	25.6335	80.576	2835164	542561	native fern, W side of Chekika Rd.		
72	Auracaria heterophylla	25.6065	80.575	2832176	542670	landscape plants at large house for Park housing.		
72	Bougainvillea spectabilis	25.6065	80.575	2832176	542670	landscape plants at large house for Park housing.		
72	Cocos nucifera	25.6065	80.575	2832176	542670	landscape plants at large house for Park housing.		
73	Mangifera indica	25.6015	80.5749	2831621	542688	remnants of an old orchard. W side of Chekika Rd.		
74	none	25.569	80.5751	2828024	542674	spot where field of view estimates were taken.		
75	Bischofia javanica	25.6047	80.5761	2831979	542566	Large Bishopwood tree with many offspring.		
75	Wedelia trilobata	25.6047	80.5761	2831979	542566	along path where the large Bishopwood tree is located.		
75	Blechum pyramidatum	25.6047	80.5761	2831979	542566	along path where the large Bishopwood tree is located.		
75	Pennisetum purpureum	25.6047	80.5761	2831979	542566	along path where the large Bishopwood tree is located.		

“Appendix C. Photos”

Appendix E. Database Table Descriptions

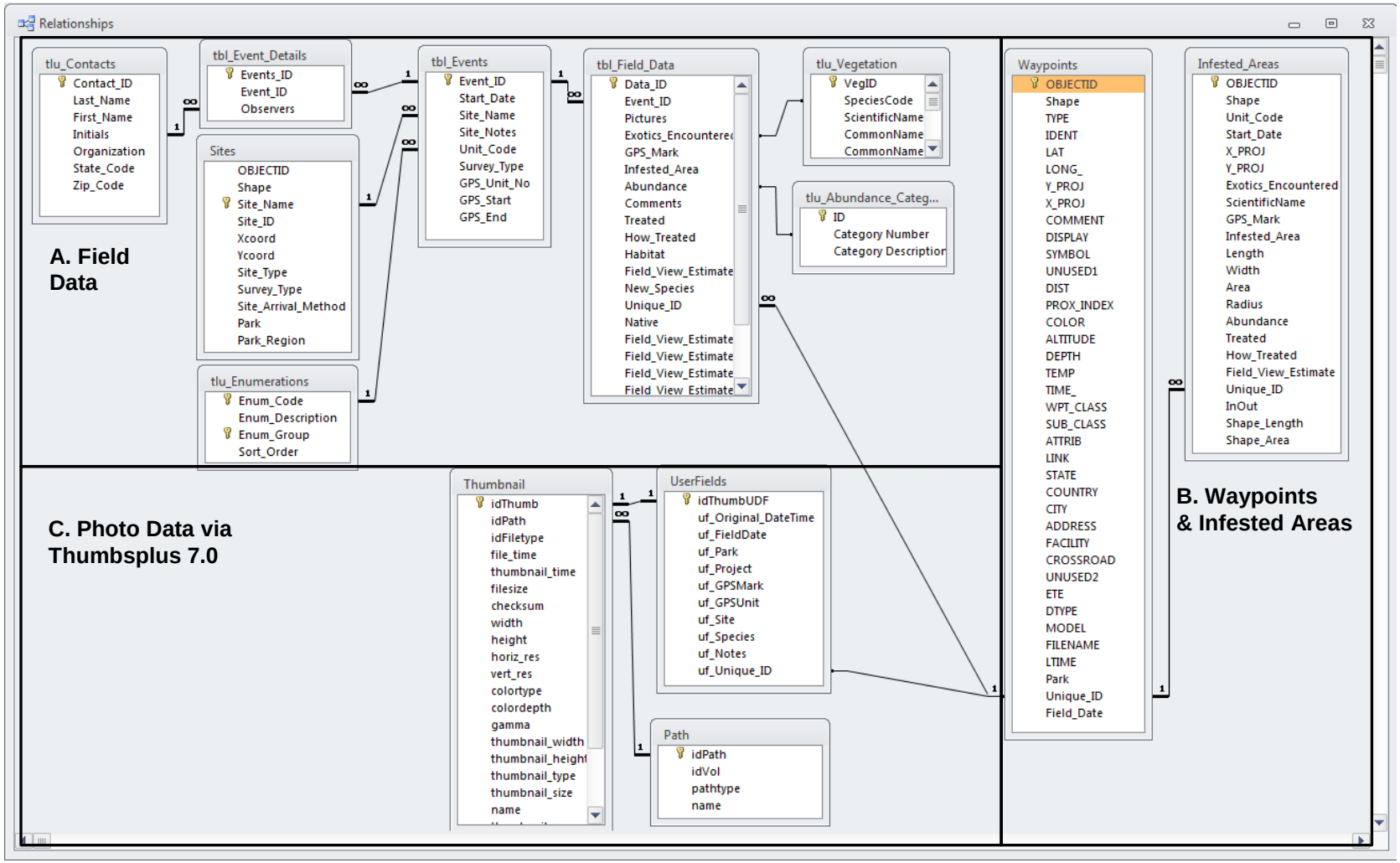

Table: tbl_Field_Data

Description: Data collected at a specific field location concerning exotic species encountered, abundance, how treated, and habitat description.

Field Name	Data Type	Description
Data_ID	Text	MA. Field data table row identifier (Data_ID)
Event_ID	Text	M. Link to tbl_Events (Event_ID)
Pictures	Text	No. of pictures taken
Exotics_Encountered	Text	Exotic Species Encountered
GPS_Mark	Text	GPS Waypoint number
Infested_Area	Text	Size of Infested Area in meters
Abundance	Number	Abundance Categories (based on number of individuals) 1= 1; 2= 2-5; 3= 6-10; 4= 11-15; 5= > 15
Comments	Text	Infested Area Comments
Treated	Yes/No	Invasives were Treated, Yes,No
How_Treated	Text	If Treated, With What
Habitat	Text	Community Type
Field_View_Estimate	Text	Field of View Estimate in meters
New_Species	Yes/No	New species to park list at time of sampling, Yes, No
Unique_ID	Text	Unique identifier that links this data to spatial coordinates in table Waypoints (Unique_ID)
Native	Yes/No	Indicates if species is native to the area (these are recorded in database but not included in reports)
Field_View_Estimate1	Text	Field of View Estimate in meters
Field_View_Estimate_Dir1	Text	Field of View Estimate direction for Field of View Estimate 1
Field_View_Estimate2	Text	Field of View Estimate in meters
Field_View_Estimate_Dir2	Text	Field of View Estimate direction for Field of View Estimate 2
Infested_Area_L	Number	Size of Infested Area in meters_length
Infested_Area_W	Number	Size of Infested Area in meters_width
Area	Number	Area of Infestation Size; [Infested_Area_L]*[Infested_Area_W]
Radius	Number	Radius calculated based on the Area field

Table: tbl_Events
Description: Data containing date and location information.

Field Name	Data Type	Description
Event_ID	Text	M. Event identifier (Event_ID)
Start_Date	Date/Time	M. Starting date for the event (Start_Date)
Site_Name	Text	MA. Name of Site visited, Link to tbl_Sites (Site_Name)
Site_Notes	Memo	MA. General notes on the site
Unit_Code	Text	M. Park code (Unit_Code)
Survey_Type	Text	Survey Type
GPS_Unit_No	Text	GPS unit number
GPS_Start	Text	Starting GPS Mark
GPS_End	Text	Ending GPS Mark

Table: tbl_Event_Details
Description: Table containing observer initials.

Field Name	Data Type	Description
Events_ID	Text	M. Event ID (Event_ID)
Event_ID	Text	M. Event ID (Event_ID)
Observers	Text	Observer initials, Link to tlu_Contacts

Table: tbl_Sites
Description: Table containing site information.

Field Name	Data Type	Description
ID	AutoNumber	Auto number
Site_Name	Text	Name of Sites, Link to tbl_Events (Site_Name)
Park	Text	Park Code
Site_Type	Text	Type of Site
Survey_Method	Text	Survey Method
Region	Text	Cardinal direction
Site_Arrival_by	Text	Method of transportation used to reach site
Site_ID	Text	Site ID number

Table: UserFields
Description: A ThumbsPlus 7.0 table containing data related to each photo based on field observations.

Field Name	Data Type	Description
idThumbUDF	Number	Unique ThumbsPlus Generated ID number
uf_Original_DateTime	Text	Camera date and time (assumes camera date is correct)
uf_FieldDate	Date/Time	Field date of data collection
uf_Park	Text	Park 4 letter code (EVER, BISC, BICY)
uf_Project	Text	SFCN Project/Vital Sign (Corridors of Invasiveness)
uf_GPSMark	Text	GPS Mark
uf_GPSUnit	Number	Gps unit number given by SFCN
uf_Site	Text	Site within the Park where survey occurred
uf_Observer	Text	Field observers
uf_Species	Text	Exotic species (six letter code consisting of first three letters of the genus and first three lette
uf_Notes	Text	General comments or habitat descriptions

Table: Thumbnail

Description: A ThumbsPlus 7.0 table containing filename for the image.

Field Name	Data Type	
idThumb	AutoNumber	Thumbnail ID
idPath	Number	Path ID for file
idFiletype	Number	File type
file_time	Number	Date file was last written
thumbnail_time	Number	Time thumbnail was made
filesize	Number	File size (bytes)
checksum	Number	Thumbnail checksum
width	Number	Image width
height	Number	Image height
horiz_res	Number	Horizontal resolution (PPM)
vert_res	Number	Vertical resolution (PPM)
colortype	Number	Color type (encoded)
colordepth	Number	Color depth (bits per pixel)
gamma	Number	Assumed Gamma (*10)
thumbnail_width	Number	Thumbnail width
thumbnail_height	Number	Thumbnail height
thumbnail_type	Number	Thumbnail type
thumbnail_size	Number	Size of thumbnail (bytes)
name	Text	File name
thumbnail	OLE Object	Thumbnail image name
annotation	Memo	Brief description
metric1	Binary	Metric1 value
metric2	Binary	Metric2 value
metric3	Binary	Metric3 value

Table: Path

Description: A ThumbsPlus 7.0 table containing server pathname for location of photo.

Field Name	Data Type	
idPath	AutoNumber	Path ID
idVol	Number	Volume id of path
pathtype	Number	Type of path (invalid, dir, zip)
name	Text	Path

Table: Waypoints

Description: Linked to Waypoints_Shape_Index. Shapefile created by appending waypoint shapefiles created from GPS unit data. Provides LAT, LONG, and UTM coordinate data for all field locations and exotic locations mentioned in the database.

Field Name	Data Type	Description
OBJECTID	AutoNumber	Number of point automatically assigned by ArcMap GIS
Shape	OLE Object	Geometric information of the point
TYPE	Text	File type: Waypoint
IDENT	Text	GPS mark number (ID)
LAT	Number	Latitude
LONG_	Number	Longitude
Y_PROJ	Number	UTM northing (y) centroid coordinate based on Zone 17 North
X_PROJ	Number	UTM easting (x) centroid coordinate based on Zone 17 North
COMMENT	Text	Date collected
DISPLAY	Text	Default GPS Field (blank)
SYMBOL	Text	Number representing the symbol displayed for waypoint in GPS Unit
UNUSED1	Text	Default GPS Field (blank)
DIST	Number	Default GPS Field (blank)
PROX_INDEX	Text	Default GPS Field (blank)
COLOR	Text	Default GPS Field
ALTITUDE	Number	Altitude in meters
DEPTH	Number	Default GPS Field (blank)
TEMP	Number	Default GPS Field (blank)
TIME_	Text	Default GPS Field
WPT_CLASS	Text	Default GPS Field (blank)
SUB_CLASS	Text	Default GPS Field (blank)
ATTRIB	Text	Default GPS Field
LINK	Text	Default GPS Field (blank)
STATE	Text	Default GPS Field (blank)
COUNTRY	Text	Default GPS Field (blank)
CITY	Text	Default GPS Field (blank)
ADDRESS	Text	Default GPS Field (blank)
FACILITY	Text	Default GPS Field (blank)
CROSSROAD	Text	Default GPS Field (blank)
UNUSED2	Text	Default GPS Field (blank)
ETE	Text	Default GPS Field (blank)
DTYPE	Text	Default GPS Field (blank)
MODEL	Text	GPS unit model
FILENAME	Text	Site Name
LTIME	Text	Default GPS Field
Park	Text	Park Acronym
Unique_ID	Text	Unique ID: Combination of Park Acronym, Field Date, and Ident number. Link to tbl_Field_Data (Unique_ID)
Field_Date	Text	Field Date (YYYYMMDD)

Table: Tracklines

Description: Linked to Tracklines_Shape_Index. Shapefile created by appending trackline shapefiles created from GPS unit data.

Field Name	Data Type	Description
OBJECTID	AutoNumber	Number of point automatically assigned by ArcMap GIS
Shape	OLE Object	Geometric information of the point
TYPE	Text	FGPS File type: Track
IDENT	Text	Default GPS Field
LAT	Number	Latitude
LONG_	Number	Longitude
Y_PROJ	Number	UTM northing (y) centroid coordinate based on Zone 17 North
X_PROJ	Number	UTM easting (x) centroid coordinate based on Zone 17 North
NEW_SEG	Text	Default GPS Field
DISPLAY	Text	Default GPS Field
COLOR	Text	Default GPS Field (blank)
ALTITUDE	Number	Altitude
DEPTH	Number	Default GPS Field (blank)
TEMP	Number	Default GPS Field (blank)
TIME_	Text	Default GPS Field
MODEL	Text	Default GPS Field
FILENAME	Text	Site Name
LTIME	Text	Date and Time collected
SurveyType	Text	Survey Type
Length_km	Number	Length of trackline in km
Park	Text	Park Acronym
Shape_Length	Number	Perimeter length of the polyline in meters

Table: Infested_Areas

Description: Linked to Infested_Areas_Shape_Index. Shapefile created by buffering waypoints to create infested area polygons and/or by digitizing infested areas based on aerial imagery. This shapefile contains all new Area data.

Field Name	Data Type	Description
OBJECTID	AutoNumber	Number of point automatically assigned by ArcMap GIS
Shape	OLE Object	Geometric information of the point
Park	Text	Park Acronym
Year_	Number	Year collected
Start_Date	Date/Time	Field date
X_PROJ	Number	UTM easting (x) centroid coordinate based on Zone 17 North
Y_PROJ	Number	UTM northing (y) centroid coordinate based on Zone 17 North
Exotics_Encountered	Text	Species code for exotics encountered
ScientificName	Text	Scientific name for exotics encountered
GPS_Mark	Text	GPS mark number (ID)
Length	Text	Size of Infested Area in meters_length
Width	Text	Size of Infested Area in meters_width
Area	Text	Area of Infestation Size; [Infested_Area_L]*[Infested_Area_W]
Radius	Text	Radius calculated based on the Area field
Abundance	Text	Abundance Categories (based on number of individuals) 1= 1; 2= 2-5; 3= 6-10; 4= 11-15; 5= > 15
Abundance_Details	Text	Infested Area/Abundance Comments
Treated	Number	Invasives were Treated, Yes,No
How_Treated	Text	If Treated, With What
Field_View_Estimate1	Text	Field of View Estimate in meters
Field_View_Estimate_Dir1	Text	Field of View Estimate direction for Field of View Estimate 1
Field_View_Estimate2	Text	Field of View Estimate in meters
Field_View_Estimate_Dir2	Text	Field of View Estimate direction for Field of View Estimate 2
Unique_ID	Text	Unique identifier that links this data to spatial coordinates in table Waypoints (Unique_ID)
InOut	Text	Specifies if polygon falls "inside" or "outisde" the field of view.
Shape_Length	Number	Perimeter length of the polygon in meters
Shape_Area	Number	Area of the polygon in square meters

Table: Corridors_FieldofView

Description: Linked to Corridors_FieldofView _Shape_Index. Shapefile created by digitizing original tracklines and buffering them based on the field of view estimates.

Field Name	Data Type	Description
OBJECTID	AutoNumber	Number of point automatically assigned by ArcMap GIS
SHAPE	OLE Object	Geometric information of the point
SHAPE_Length	Number	Perimeter length of the polyline in meters
Park	Text	Park Acronym
Field_Date	Text	Field date (YYYYMMDD)
Comments	Text	Comments about digitized lines
Site_Name	Text	Site Name
Length_km	Number	Length of trackline in km
Suvey_Type	Text	Survey Type
FieldView_East	Number	Field of View Estimate in meters for East
FieldView_West	Number	Field of View Estimate in meters for West
FieldView_North	Number	Field of View Estimate in meters for North
FieldView_South	Number	Field of View Estimate in meters for South

Table: tlu_Contacts

Description: A lookup table for observers implementing the protocol.

Field Name	Data Type	Description
Contact_ID	Text	M. Contact identifier (Contact_ID)
Last_Name	Text	M. Last name (Cnt_Last)
First_Name	Text	M. First name (Cnt_First)
Initials	Text	Initials of Observer
Organization	Text	M. Organization or employer (cntorg)
State_Code	Text	M. State or province (state)
Zip_Code	Text	M. Zip code (postal)

Table: tlu_Vegetation

Description: Look up table for vegetation information, contains common names and scientific names.

Field Name	Data Type	Description
VegID	AutoNumber	
SpeciesCode	Text	first three letters of the genus and species from the scientific name combined together
ScientificName	Text	Scientific Name
CommonName_STX	Text	common name used on St. Croix
CommonName_STJ	Text	common name used on St. John
CommonName_FL	Text	common name used in South Florida
CommonName_Other	Text	common names from the ITIS database
CommonName_Source	Text	sources for the common names in the 4 fields above
Scientific_ITIS	Text	scientific names from the ITIS database
Family	Text	Scientificy family name
Phenology	Text	timing (or abscence) of leaf drop
Phenology_Source	Text	Source of phenology
Nativity_VirginIslands	Text	Is this plant native to the U. S. Virgin Islands?
Nativity_SouthFlorida	Text	Is this plant native to South Florida?
VirginIslands	Yes/No	is the plant found in the the U.S. Virgin Islands?
SouthFlorida	Yes/No	is the plant found in South Florida?
Done	Yes/No	is this lookup table entry done?

Table: tlu_Abundance_Categories

Description: Look up table for Abundance Category descriptions.

Field Name	Data Type	Description
ID	AutoNumber	Auto Number
Category Number	Number	Category Number
Category Description	Text	Abundance Categories (based on number of individuals) 1= 1; 2= 2-5; 3= 6-10; 4= 11-15; 5= > 15

Table: tlu_Enumerations

Description: Look up table that holds Park and Organization information used in other fields throughout the database.

Field Name	Data Type	Description
Enum_Code	Text	Code for lookup values (Park, Organization Acronym)
Enum_Description	Memo	Lookup value description (Park, Organization Names)
Enum_Group	Text	Category for lookup value
Sort_Order	Number	O. Order in which to sort lookup values (Sort_Order)

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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